MAY, 1924

Railway Engineering and Maintenance

RAILWAY ENGINEERING AND MAINTENANCE
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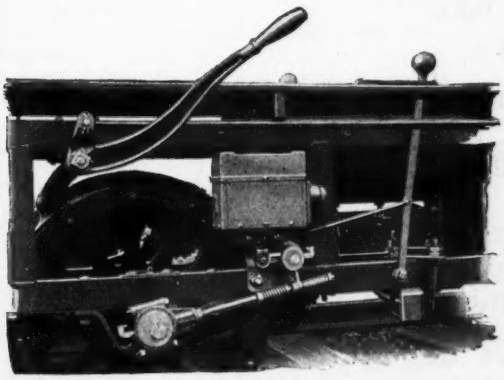

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A Locomotive on a New Turntable on the Bessemer & Lake Erie.

Railway Engineering and Maintenance

Formerly the Railway Maintenance Engineer

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How to build a culvert through a high embankment?

How to lay tracks in city streets?

How many accidents are caused by faulty maintenance?

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How to find obstructions in water lines?

Answers to these and other practical questions will be found elsewhere in this issue.

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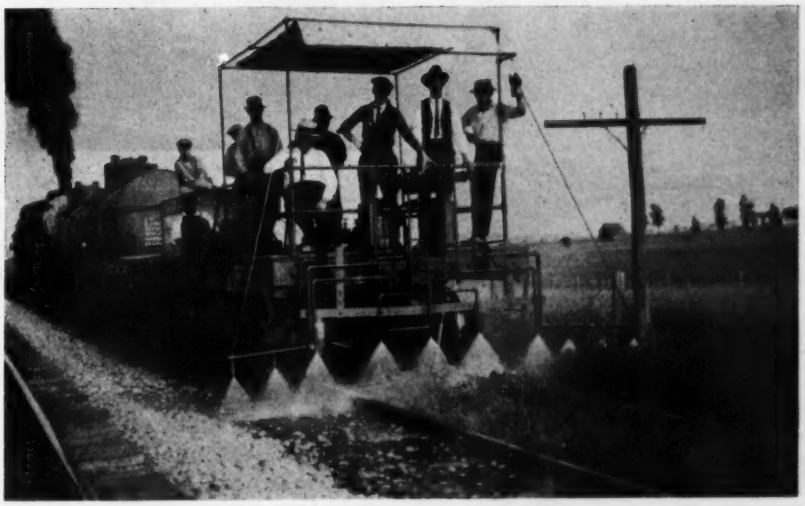

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* *Railway Engineering and Maintenance, March, 1923.*

Top—A twelve tool ballasting gang on the L. V. R. R.

Center—9x8 Type Twenty Portable Air Compressor for operating twelve pneumatic tampers.

Bottom—Twelve tamper skid mounted compressor at side of track.

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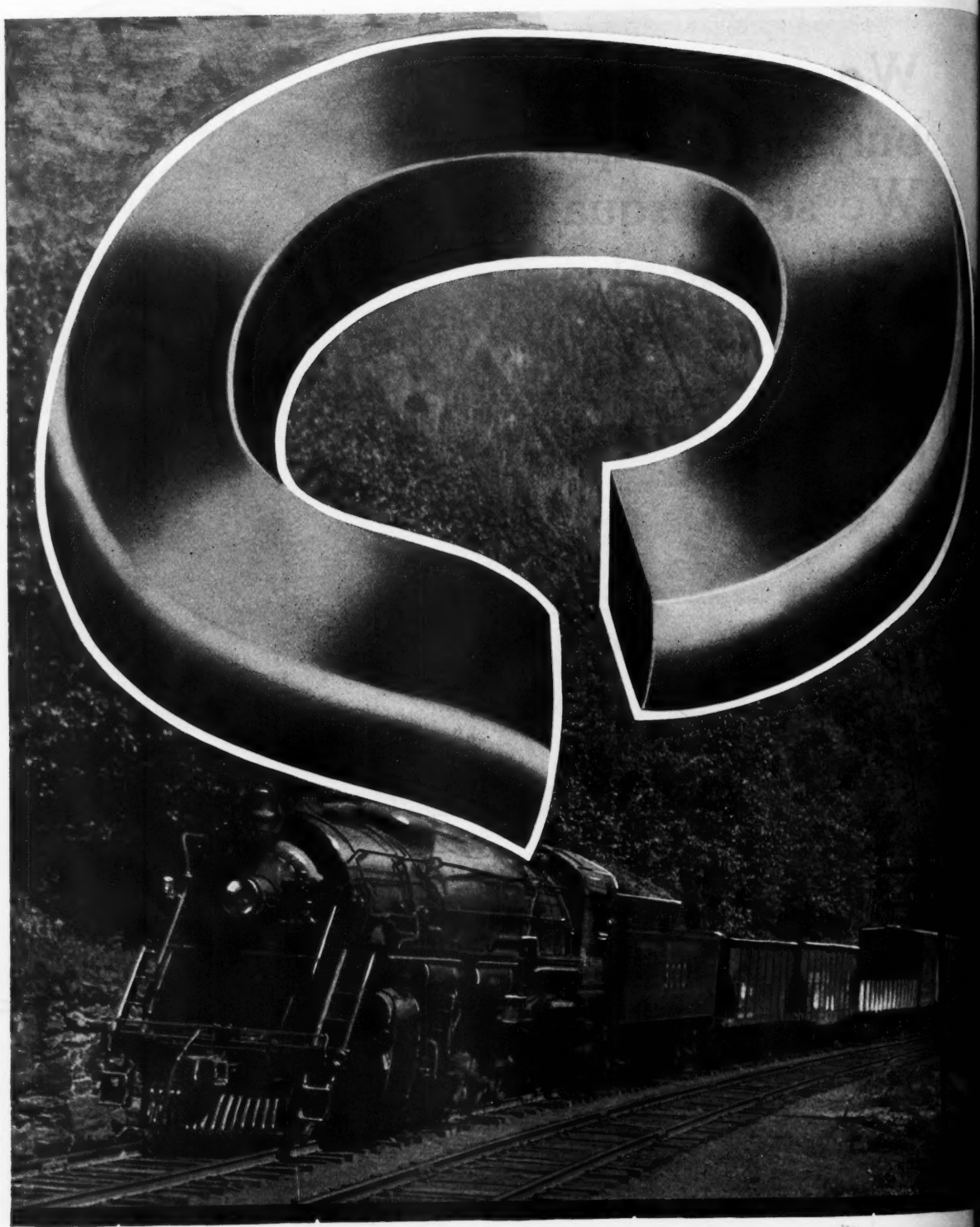
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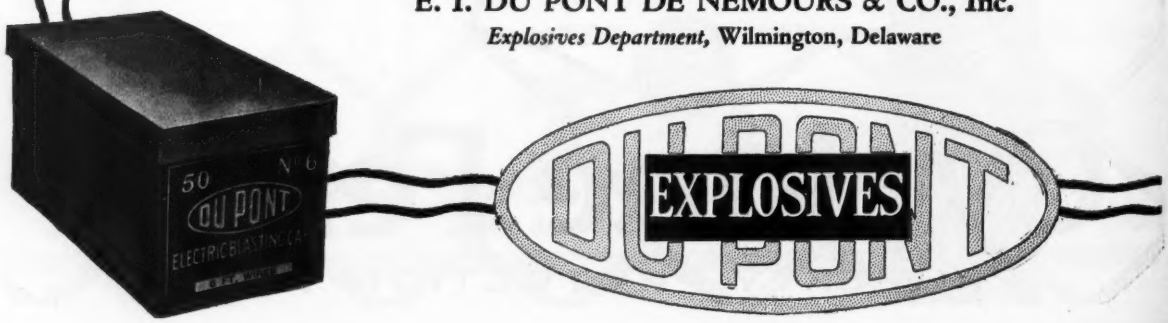

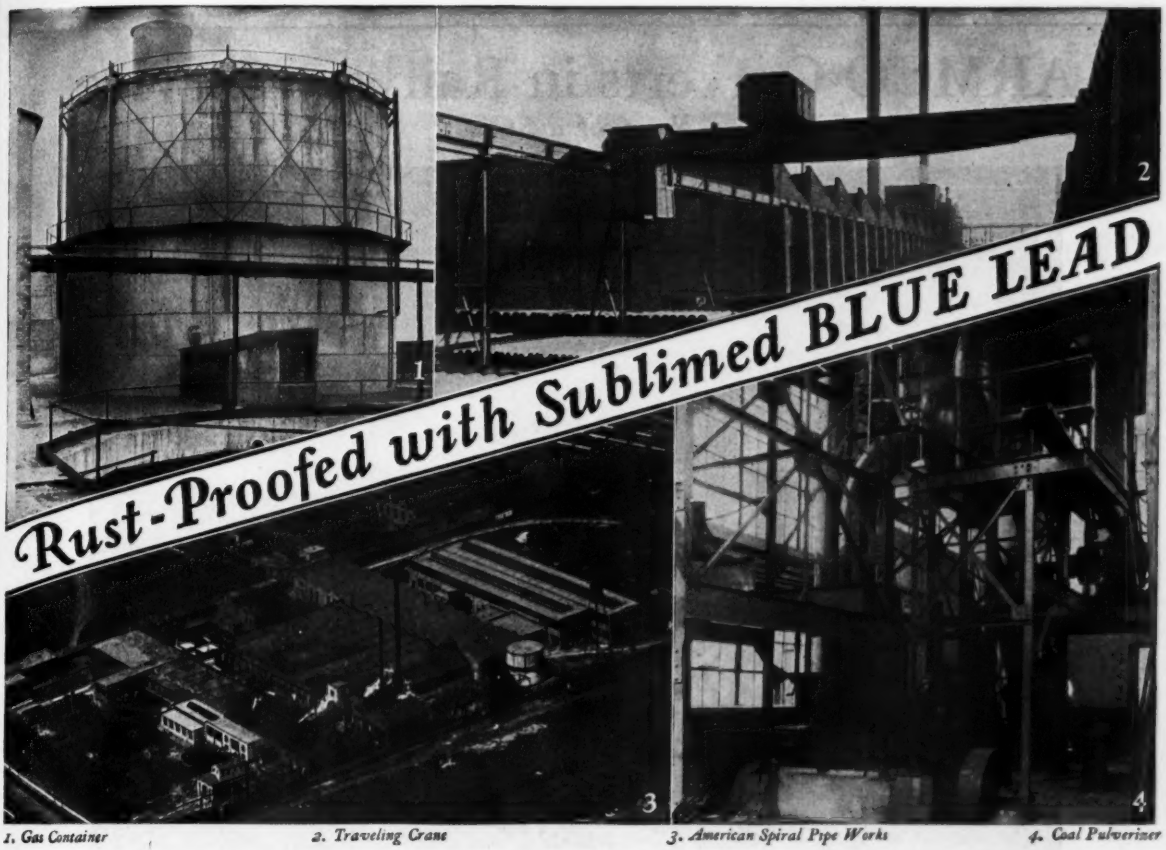

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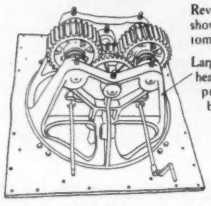

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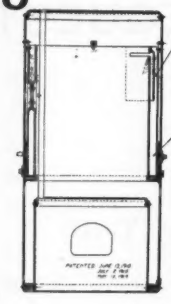

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INDUSTRIAL LOCOMOTIVE CRANES

Railway Engineering and Maintenance

Volume 20 May, 1924 No. 5

A FOREMAN'S RESPONSIBILITY

AT THIS season of the year when floating gangs are being recruited and the regular section and other maintenance gangs are being increased to a summer basis, many men inexperienced in maintenance of way work are being employed. Because of the unfamiliarity of a large part of these men with the hazards of railway service, the foremen under whose supervision they work are charged with a special responsibility to see that they are properly instructed in methods of work so that they will avoid injuring themselves and those about them.

Every analysis of accidents to railway employees makes it increasingly evident that the control of accidents rests largely with the foremen. On no other basis can the wide discrepancy between the records of various gangs be explained. A study of the accidents on almost any road will show that a relatively large proportion of the men in some gangs have incurred injuries, while those in other gangs have escaped injuries for long periods.

The railways have made great progress in the reduction in the number of employees killed and injured in recent years. This has been due in large measure to the success which has followed their efforts in impressing upon employees the necessity for individual responsibility. It is, however, a subject which requires constant repetition for careless habits are easily acquired and are seldom detected until brought to light by an accident.

The fact that maintenance of way employees are required to work on tracks and structures over which trains are passing at frequent intervals and the necessity for them to handle heavy materials requires the constant exercise of a high degree of vigilance. A foreman who can take a gang through a season without a single injury has established a record of which he and his road may well be proud. The achievement of this goal is within the reach of every foreman. He should be satisfied with nothing less.

SAVE MONEY BY PUSHING WORK NOW

ALTHOUGH the railways have handled more traffic so far this year than in the same period of any previous year and, although the volume now moving is greater than at this time in any earlier year, with the single exception of 1923, a number of the roads are showing considerable hesitation in launching their season's programs of maintenance work. While the tracks and structures entered last winter in unusually good shape, and while the winter was favorable in most areas, the wear and tear due to the heavy traffic has been severe and there is at least a normal amount of work to be done.

No single factor contributed more to the orderly and economical conduct of work last year than the early inauguration of the programs. In many instances the work was so well advanced by mid-summer that the roads made no attempt to replace the men who went to the harvest fields. It is unfortunate that similar progress is not being made this year for while the indications are that there will be an adequate supply of labor in most areas, the men can be selected more carefully early in the season and they will work more efficiently now than in the hotter months. Furthermore, with a given-amount of work to be done it requires no elaborate argument to demonstrate that a smaller force of men working continuously throughout the season will accomplish more and at less cost than a larger force hurriedly organized and less experienced, will do in a shorter period.

This hesitation cannot be justified on the ground of economy for its effect is to

A MUTUAL INTEREST

A short time ago the employees on an important division of a western railway organized and manned a "booster" special which they ran over their division, calling on the merchants and other shippers in each town to solicit their traffic. These employees operated the train without expense to the road as far as wages were concerned. The giving of their time in this way for the promotion of the interests of their road is an evidence of loyalty to their road which is to be commended. It shows also that these men recognize that they have interests in common with their employers, for the greater the amount of traffic handled the larger is the number of trains required and the more work there will be.

There are many channels through which employees of the maintenance of way and other departments can aid their roads and themselves. It is within the province of every employee to secure the routing over their line of traffic that is now moving over the rails of competing roads or by motor truck or motor bus. The answering of criticisms of and the disseminating of facts regarding the roads and their performances will go a long way towards counteracting the malicious propaganda which is being directed against the railroads today by some who are seeking political office or are prompted by other ulterior motives. Railway employees owe a duty to their employers to promote their interests. In the performance of this duty they are also promoting their own interests, for they cannot expect to prosper to a greater degree than the roads from which they derive their livelihood.

increase the cost of the work. Neither can it be attributed to uncertainty regarding the work to be done for a large part of it must be done at any event. It is due more to indecision than to real necessity, the result of which will be to add many thousands of dollars to the final cost, direct and indirect, of the work. Maintenance officers of all ranks can do much to promote economical maintenance by utilizing their full authority to start their work promptly and, beyond this point, to impress the economy of such a program on their superior officers.

NEATNESS, OCCASIONAL OR HABITUAL

EVERYONE who has ever worked for a railroad is familiar with the unusual activity that customarily follows the news of the approach of the president's special. Word is passed quickly up and down the line to clean up the right-of-way, to pile all loose material that can be piled and to hide everything that might result in criticism. Much energy is devoted to the correction or covering up of conditions that would afford occasion for adverse comment.

This practice dates back to the earliest days of railroading. It has its justification in the disciplinary effect it has on the entire organization. While orderliness may be carried to extremes, disorder produces careless slovenly methods and waste of materials. Therefore, it behooves subordinate maintenance officers to insist on orderliness at all times and to insist upon such work as cannot be conducted in a tidy manner being carried on as neatly as practical without the expenditure of additional money and that these untidy conditions be corrected at the earliest possible date. Maintenance officers in direct charge of field operations may well call this to the attention of their foreman as they are opening their season's work in order that all operations may be cleaned up as they progress and the accumulation of work of this character avoided later in the season.

THE TENDENCY TOWARDS LONGER AND HEAVIER RAILS

AN order for 131,000 tons of rails is sufficiently unusual to attract interest at any time. When it is specified that this entire tonnage shall be rolled in 39-ft. lengths, it is still more unusual. Such is the order which the Southern Pacific placed with three mills last month. This purchase is also unusual, at least in so far as western roads are concerned, in that 82,231 tons of the 131,245 tons will be of 110-lb. section.

It is evident from this that the Southern Pacific has definitely decided on longer and heavier rails. This action is in keeping with the tendency which has been evident for some time. Numerous roads have endeavored to secure rails longer than the standard 33-ft. lengths for the last three or four years and some orders have been placed with the understanding that a small percentage would be rolled in 39-ft. lengths. However, the imposition by most of the mills of an added charge or premium for rails longer than 33 ft. has deterred the roads. With the Southern Pacific order as a precedent, it is to be expected that the pressure from other roads will become so great that the mills cannot long resist their demands.

This tendency towards longer rails is in keeping with the development in maintenance of way methods and standards. The use of heavier rails and heavier sections, the more general application of rail anchors and additional ballast have all contributed to heavier track construction in which the control of expansion is less of a problem. The growing use of mechanical equipment for the unloading and laying of rails is eliminating the objection to their weight, while the increasing length of cars and the large number of 40-ft. cars now in service affords sufficient equipment for the transportation of the rails from mills to track. The most serious obstacle in the way of the use of longer rails is the construction within certain of the mills which makes the handling of rails longer than 33 ft. laborious and expensive, tending to reduce output.

The heavier section is also in keeping with modern tendencies. A number of eastern roads have been using rails up to 136-lb. section for a number of years, although the 90-lb. and 100-lb. sections have been the heaviest in general use on the western roads, with the possible exception of the Great Northern's order for 130-lb. rails for installation on curves on its mountain divisions last year. Also, in going from 90-lb. to 110-lb. rails at one jump, the Southern Pacific has avoided the multiplication of standards which have been found on a number of other roads which have made smaller increases.

ANOTHER REASON FOR THE USE OF LABOR-SAVING EQUIPMENT

IT IS evident from the decisive votes recorded in both the House and the Senate during the last month that immigration will be still further curtailed after June 30 and that the number of aliens who will be permitted to enter this country in the future will be only a fraction of those entering a few years ago. Furthermore, the placing of the quotas of the various nationalities to be admitted on the basis of a percentage of those nationalities in this country in 1890 will almost stop the entrance of people from the southern European countries. As it is from these countries that the railways have drawn much of their labor for construction and maintenance of way work in recent years, it is evident that they will now be forced to look elsewhere for their men. They will undoubtedly find some relief through the greater utilization of Mexicans, who have been coming into this country in increasing numbers of late. However, even this will be only a temporary expedient and the permanent solution must rest in the development of methods which will reduce the number of men required.

The maintenance of way department has always been extravagant in the use of labor. With an adequate supply available most of the time, even at the low rates paid, they have followed the course of least resistance. As a result, the development of mechanical equipment has made less progress here than in other branches of railway service and most of the work is still done manually.

The rate at which mechanical equipment is substituted for men bares a close relation to the rates of wages. As wages rise the economy of mechanical substitutes increases and the roads can afford to pay more attention to the development of such equipment and make larger investments in it. The result which may naturally be expected from the curtailment of immigration and the arresting of the influx of unskilled labor will be to transform the surplus to a shortage and increase wages to the point where the various industries will find it economical to adopt a sufficient amount of mechanical equipment to establish a new balance between wages and labor supply.

The increased use of mechanical equipment in construction and maintenance of way operations is inevitable. The development and adaptation of such equipment to maintenance of way work will require time. Those roads will profit first and most which recognize the significance of the present trend and undertake such revisions of their methods as will enable them to use less men and employ them more efficiently by supplementing their efforts with machinery. While the results of the legislation now under consideration may not be reflected in a shortage of labor this year, it is inevitable that this will be the result in the near future and when it does occur

those roads will suffer least from this shortage who make the greatest progress in the substitution of machinery for men in the meantime.

THE CULVERT AS AN EFFICIENT WATERWAY

ON ANOTHER page of this issue a discussion of the various factors influencing the hydraulic efficiency of culverts places emphasis on a subject which is not often discussed. The selection of the type of culvert, the form of headwall or the lay of wings is usually determined by other considerations than the influence which they bear on the velocity of flow through the waterway. The article in question lays particular emphasis on these factors and offers certain conclusions, some of which run counter to prevailing practice and which may well be given serious thought. On the other hand, it would seem that authors have overlooked some phases of culvert installation and maintenance which are of prime importance and which may, therefore, afford good reasons for not following the strict letter of the conclusions offered.

The results of the tests show that the sloping of a culvert is of no advantage when the pipe is flowing full or under a head and that the full effectiveness of a culvert pipe is not obtained unless the culvert is flowing full. However, every railroad officer can cite cases where it is necessary to install a culvert of such size that it will rarely flow under a head, that is, where there would be serious objections to the backing up of a sufficient amount of water to make this possible. Moreover, culverts are often given a pitch to insure that the sag which will occur in the pipe with the settlement of the embankment will not result in making the center of the culvert lower than the downstream end. Again, there are many cases where the angle of the wing walls must be determined so that the wings will fit the lay of the land to avoid excessive excavation or to insure that they may conform to the position or direction of the stream bed at the ends of the culvert. However, in spite of these criticisms, it is believed that the article in question may offer suggestions that will be found valuable.

TAKE AN INTEREST IN THE NEW WORK

IT IS NOT enough that a maintenance officer interest himself in the best methods of conducting the work for which he is directly responsible. He should also be vitally concerned in the character of construction applied in the improvements and additions carried out on the district in which he is employed. This is a matter of vital importance to the bridge and building officer for just as the maintenance of track is made easier by the use of heavier rail, larger ties and better ballast, so are the problems of building maintenance greatly reduced by the replacement of antiquated structures by new ones of better design.

Consider a roundhouse, for example. A modern, indirect heating system with concrete ducts relieves the maintenance officer of the burden of the frequent replacement of sheet metal ducts or of the care of many thousands of feet of pipe coils in engine pits and elsewhere. Concrete engine pits with good drainage relieve the bridge carpenter of the dirty job of replacing foul and rotted timber crib pits. Modern buildings with large area, steel sash windows and effective artificial flood lighting make for better housekeeping by the roundhouse force and insure that when a repair job is necessary it will be done under more satisfactory conditions than those which are encountered in the dark holes that went under the name of roundhouses in the past.

These conditions make it of interest to the master carpenter and his superior officers to point out to their managements the advantage of better construction from the maintenance standpoint. But the responsibility goes even further, for, as improvements are made, new ideas must be applied. Some of these are necessarily experimental and require modification before the best designs have been developed and it is in this connectoin that maintenance officers can be of unquestioned value in imparting their experience with such experimental installations. In offering their opinions they should guard against an antagonistic view. It serves no purpose to say that an installation is no good. One must be in a position to tell why it has failed and be ready to offer suggestions for improving the design. Moreover, it is not beyond reason to propose that there are occasions under which it would be within the province of the bridge and building supervisor to suggest improvements which, in his opinion, would make for longer life and easier maintenance.

AN ENLARGING OPPORTUNITY

THE increasing tendency of the railways to select executive officers from the ranks of those who have been trained in engineering and maintenance of way work is evidenced by the promotions recorded in the news columns of this issue. During the last month three vice-presidents, two general managers, one assistant general manager and one general superintendent, have been selected from among men with this training. This indicates a change from the practice of ten or twenty years ago when the line of promotion to executive positions was limited largely to those whose experience had been gained in the transportation department. It is a reflection of a transition in the character of the problems which is facing executive officers today. It is even more an indication of a change in the attitude of engineering and maintenance officers towards transportation problems.

In the pioneer development days of the American railways the activities of the engineer were limited largely to construction and his ability as a maintenance or operating officer was given little consideration. In fact, many engineers refused to enter maintenance of way work because of the more routine character of that work and the lack of the spectacular which characterized much of the construction.

More recently there has been an increasing appreciation on the part of operating and executive officers of the important relation which the maintenance of way structures bears to the movement of traffic. Maintenance officers have also come to appreciate the opportunities which they have to promote the movement of traffic by the efficient administration of the work of their department. As a result a closer contact has been established between the men of these departments which has resulted to their mutual advantage. It has been of particular benefit to the maintenance man by affording him an opportunity to acquire an understanding of the fundamental principles of transportation and thus fit him for promotion. That he has taken advantage of this opportunity is indicated by the appointments referred to above. That those of similar training who have preceded him into executive positions have made good is indicated by the fact that more than 40 men who are now presidents, vice-presidents and general managers of important roads have qualified by similar training.

These men are pointing the way for other maintenance men and are living demonstrations of the opportunities for advancement which are available without as well as within their department.

Letters to the Editor

ANOTHER WAY TO CUT A RAIL

Chicago.

TO THE EDITOR:

The article on page 149 of the April issue of *Railway Engineering and Maintenance* describes a very good way to cut a rail, especially if it is a short cut, but personally, I do not like to use a chisel on the ball of a rail as that causes pounding joints. If seven feet or more is to be cut off,' Mr. Lull's way is slow. At any rate, in the Clearing yards of the Belt Railway of Chicago we use a method that we think is much faster. This is how we do it. We lay two ties crosswise of the track 29 to 30 ft. apart. We then lay the rail to be cut on top of these ties with the ball up. We measure along one edge of the base to the cutting point and make a chalk mark. Then we do the same thing along the other side of the base of the rail.

The next step is to turn the rail on one side, after which six men bear down on it with lining bars caught under the ball of one of the rails in the track, the same as shown in chart No. 4 in the article referred to, except that the rail is swinging in the center and three of the bars are on each side of the chalk mark while the man with the chisel is standing between the bars at the mark and holding the chisel as shown in chart No. 2. All of the men stand on one side of the rail except the man with the sledge who strikes the chisel while the six men are bearing down with their bars.

We then turn the rail over on the other side and do exactly as before. It usually takes only one blow on each side to break an 80-lb. rail, or two blows on each side for a 100-lb. rail.

In using this method it is necessary to be careful to have all the men ease up on the bars together after the cut is made on the first side and also to keep their feet out from under the rail when striking on the second side. We find that with this method we can cut rail in less than two minutes and that the cut is clean and square without any burrs. In hot weather we find it a good idea to throw a pail of cold water over the rail at the point to be cut.

JAMES VITATO.
Track Foreman, Belt Railway of Chicago.

ZINC OXIDE DOES NOT DISCOLOR

New York.

TO THE EDITOR:

The fact that such compounds of zinc as oxide, sulphide, sulphate and carbonate are either white or colorless has been known so long, and the use of zinc oxide in preparations designed to withstand the action of sulphureous gases has been so general, that certain statements appearing in the January issue of your publication under the title "Titanium Pigment for Signs and Interiors" are startling, and quite at variance with actual facts.

In this article we find the following statement: "Zinc Oxide pigment is susceptible to discoloration and is not recommended where sulphureous gases are likely to affect the pigment." Zinc sulphide is white and neither zinc oxide nor lithopone is discolored by sulphureous gases. Lead sulphate being black, the lead pigments are the ones which are so discolored when used in paint for industrial communities. It is unfortunate that statements such as that quoted above find their way into print.

Two types of paint which are suitable for use in places exposed to sulphureous gases are those based on a zinc oxide—inert pigment mixture and those made from zinc oxide lithopone and inert pigment. An example of the former is paint containing as pigment 60 per cent zinc oxide and 40 per cent barytes; while the proper combination for the latter type is 40 per cent zinc oxide, 40 per cent lithopone, 10 per cent silica, and 10 per cent asbestine. Both paints have been used for years with success.

Zinc oxide and lithopone are eminently suited for the manufacture of interior finishes. They are used for laboratory enamels, which is the most severe test to which a pigment can be subjected as regards resistance to fumes.

Commenting on the hiding power of Titanox, the author states that it is "three times that of white lead and double that of zinc oxide." This is approximately correct *if the pigments are all reduced to the same low brightness of the poorest one* in the group—and are then tested for hiding power. The statement may hold also for certain tints and dull whites. However, for white paint zinc oxide and lithopone are not deliberately made muddy and their brightness spoiled. The selection of a white pigment, whether white lead, Titanox, zinc oxide, lithopone or extra strength lithopone, will practically never depend solely on hiding power; for other factors enter as, for example, brightness, settling in the can, etc. However, if paint of high hiding power is desired, the relative hiding power of the pigments becomes of great importance and in general what is desired is maximum hiding power per unit of cost. On this basis lithopone leads all other white pigments.

Some pigments are much more brilliant than others, which means that they give brighter, whiter paint surfaces and clearer tints. As marketed commercially, Titanox, zinc oxide, lithopone, and extra strength lithopone are brilliant pigments, while basic carbonate white lead is not so bright.

At a brightness approximating that of basic carbonate white lead, which is the point where Titanox shows three times the hiding power of white lead and twice that of zinc oxide, the hiding power of lithopone is only about 8 per cent less than that of Titanox and that of extra strength lithopone is *about 30 per cent greater than that of Titanox.*

C. F. BEATTY,
Advertising Manager, New Jersey Zinc Company.

New Books

Principles and Practices of Upkeep Painting. Edited by Roy C. Sheeler. 6 in. by 9 in. 200 pages, illustrated. Bound in fabrikoid. Prepared and published by the E. I. du Pont de Nemours & Co., Philadelphia, Pa. Price $2.

The title of this book is particularly indicative of the scope of the material which is included in its pages, as the text covers in simple, practical fashion modern painting practice for all types of exterior and interior surfaces. It shows both by text and by illustration, the reasons for the decay and deterioration of materials and paints and describes the latest and most modern methods to follow in overcoming these difficulties. Each class of building material is treated separately and the methods of surface preparation, paint application, etc., are furnished in detail.

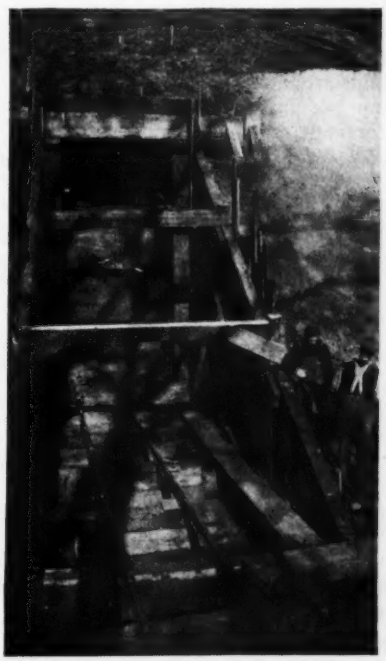
While the entire book forms a practical guide of use to railway men in the handling of plant and equipment maintenance it is likewise of value in regard to new construction. One section of the book of particular interest at the present time is a chapter on spray painting in which are included important facts on this method of painting as well as comparative figures on costs.

Replacing a Culvert by Tunneling

Unique Methods of Driving and Backfilling Result in Economical Completion of Difficult Work

By F. H. Cramer,
Assistant Bridge Engineer, Chicago, Burlington & Quincy, Chicago

THE REPLACEMENT of a culvert under a 57-ft. fill on the Chicago, Burlington & Quincy near Bethany, Mo., imposed a difficult problem which was solved by the adoption of the tunneling method. The reasons for adopting this plan, together with the manner in which the work was carried out, include many features of more than usual interest. The old culvert was a 60-in. wooden barrel built in 1868 at the time the line was constructed. It was 200 ft. in length and consisted of 4 in. by 6 in. timber staves held together by rings composed of 56-lb. rails spaced at intervals of 4 to 6 ft. Repeated flooding of the land on the upper side of the culvert during the course of spring rains forced the conclusion that the culvert was inadequate and led to the decision to replace it with an 8 ft. by 8 ft. concrete box culvert. This obviously imposed a much more formidable problem than that encountered where the old waterway is of adequate size to permit the installing of the new structure within the old one. After careful studies of the situation, comparative estimates were made of construction by open excavation and by tunneling and it was concluded that the cost by the tunneling method would be considerably less.



The Tunnel Portal

Among the objections to the open excavation were the fact that a larger amount of excavation would be necessary and that the depth of the fill would have required the driving of two sets of falsework bents, namely, a preliminary set with short piles to serve until part of the excavation had been completed and a second set with longer piles of adequate length for the full depth of excavation. The interference with traffic imposed by the driving of the trestle and the necessity for maintaining this falsework during a considerable period while the work was in progress were also features to be avoided. The material in the embankment is a firm, tenacious clay which lends itself readily to tunneling operations.

The decision to adopt the tunneling method was followed by studies to determine the size of tunnel required for the advantageous construction of the culvert. This led to the conclusion to build a tunnel 12 ft. 8 in. in width and 19 ft. high. To avoid interference with the old culvert during construction the tunnel was opened 30 ft. west of it.

A Trestle Was Built to Facilitate the Disposal of the Spoil.

The timbering for the tunnel consisted of a second-hand 8-in. by 16-in. stringers in 14-ft. and 16-ft. lengths, 12-in. by 12-in. posts, with 4-in. by 10-in. and 2-in. by 8-in. pieces for cleats, splices, etc. The roof and floor timbers were all full length but the 19-ft. sidewall posts were built up of 12-ft. and 7-ft. pieces spliced together with a 2-in. by 10-in. scab on one side only. The splices were staggered as shown. After the sidewall timbers were placed in their permanent position 4-in. by 10-in. wales were spiked directly over the upper and lower tiers of splices on the inside and these wales were braced in turn by 8-in. by 16-in. tranverse struts placed about 8 to 10 ft. apart. A row of 12-in. by 12-in. posts spaced 8 to 10 ft. apart on the longitudinal center line, with 12-in. by 14-in. caps, supported the roof and floor at mid span. The spacing of the upper and lower struts gave sufficient room to operate the dirt and concrete cars and enabled the workmen to perform their duties expeditiously.

The first step was to build a material platform to store the concrete and gravel, and sheds for the storing of cement. A steam concrete mixer of one-yard capacity was placed on falsework about 14 ft. from the track with a long wooden concrete chute extending to the portal of the tunnel.

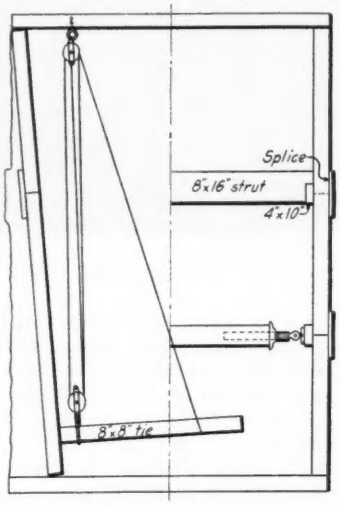
Use Portable Saw

All the timber lining was unloaded on the embankment slope and a light timber trestle 300 ft. in length was built along the toe of the slope on which all the timber was hauled to the tunnel entrance on a light rubble car. A portable rig saw, operated by a gasoline engine was also installed. This rig saw was used for cutting all the lumber for the form work and for matching timbers.

The next step was to construct the timber portal, after which excavation was started at the toe of slope and the lining was put in as the excavation progressed. The ground was found so compact that it stood up practically vertical until such time as the wing framing and back sheathing was put in. All of the dirt was hauled out over an incline tramway built of second-hand 8-in. by 8-in. bridge ties and 8-in by 16-in straingers, extending out 110 ft. from the portal of the tunnel. A small home-made dump car operated back and forth by a double

drum steam hoisting engine was used for this purpose.

The next step was to dig the 8-ft. shoulder to the portal line. Then a small trench was dug on each side so that the first sidewall timbers could be placed and the upper incline wing timbers to the portal installed. As the excavation was carried down, temporary braces were put in to hold the first three sidewall timbers so that the first floor timbers could be placed. One of the photographs shows the first timber in the portal, wing framing, braces and sheathing and the tramway track.



Method of Placing Side Wall Posts

Tunneling Method

The driving of the tunnel was carried on by the top heading and bench method. This consisted in driving a top heading 14 ft. wide and 6 ft. high for a length of about 14 ft. This first step was to excavate wide enough for one 8-in. by 16-in. by 14-ft. roof timber supported temporarily with a boxed house jack at the center. Then 4-in. by 10-in. bench sills 32 in. long were placed on each side to serve as sills for 4-in. by 10-in. posts 8 ft. long set in a skewed position to serve as temporary supports for the roof timber. This released the jack to support the next roof timber. As soon as each roof timber was put in, the 12-in. by 14-in. by 14-ft. head timber supported by posts along the center line of the tunnel was pushed ahead as the excavation and the placing of the roof timbers progressed. This operation was carried on until 14 ft. of heading was completed.

When about 8 ft. from the portal was excavated it was found that the dirt had to be cut loose with grub hoes. To handle the dirt more rapidly and to save labor a shoveling board was placed so that the dirt grubbed out dropped directly on this board. This made the shoveling much easier and faster. All the dirt excavated, except that in the extreme lower portion, was thrown into an inclined chute which delivered it directly to the tram car. A total of 1800 cu. yd. of material was excavated.

As soon as the top heading was completed, a 12-in. by 12-in. post, placed on a Norton jack, was set under the inner end of the 12-in-by 14-in. head timber with an 8-in. by 16-in. post at the other end to hold the roof timbers temporarily while the bench excavation was carried on. As the excavation progressed the floor and sidewall timbers were installed. After the floor timbers were placed, measurements were taken for the sidewall timbers which were cut a little long so that they would all fit tight. These were erected with the aid of a set of falls suspended from an eye bolt fastened to one of the roof timbers, but they were rammed into final position with an 8-in. by 8-in. tie swinging from the falls. Considerable time was saved in placing temporary bracing between sidewall timbers when installed by using a box strut with a house jack inserted at one end. Shortly afterwards, these struts were replaced with permament struts.

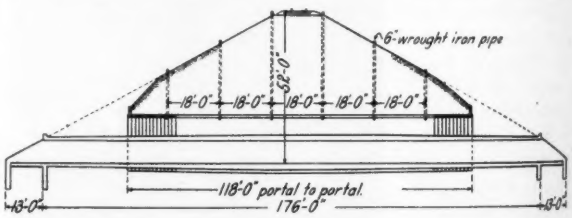
Use a Center Support

When about 40 ft. of the tunnel lining was completed the last few roof timbers placed showed signs of sagging at the center due to the pressure above. This led to a decision to put in a center support. At about this time the shortening days and the increased length of the tunnel pointed to the need of artificial light. Accordingly a horizontal steam boiler was set up to furnish steam to operate a small American headlight dynamo to supply the light needed in the tunnel. It also supplied steam for a hoisting engine and a concrete mixer and for heating the concrete materials. Four electric lights, using headlight bulbs, gave sufficient light during the progress of the excavation and the building of the forms for the concrete.

Before the concrete floor was poured it was necessary to build a box partition around all the posts in the center support. This partition was built out of one-inch boards with holes bored out to receive the reinforcing bars where necessary. The ends of the reinforcing were bent up and later when the partition and posts were taken out the bars were bent down and properly spliced. Likewise a similar partition was provided around the posts when concreting the roof. The concrete mixer was set up above the tunnel so as to be closer to the concrete materials unloaded alongside of the track and to permit the chuting of the concrete from the mixer to a concrete hopper car at the portal of the tunnel. The upper struts were placed low enough so that the car could be operated conveniently over the top of them and plank runways were built along the rails to allow the workmen to walk with the car. The car was moved back and forth with the same double drum hoisting engine that operated the tramway car.

Struts Were Shifted

The forms for the sidewalls and the roof had to be built around the lower 8-in. by 16-in. struts. When certain portions of the form work were completed and ready for concreting some of these struts were removed and replaced by short struts installed inside the form work. These were removed as the concrete was poured up to the spring line of the culvert, but to insure adequate support against the sidewall pressure after removing the short struts, only small sections of walls were poured at a time, and the posts, struts and bracing of the inside form work were built strong enough to withstand the sidewall pressure.



Cross-Section of the Embankment at the Tunnel Site

The concrete was reinforced with ½-in. and ¾-in. corrugated steel bars. Pit run gravel was used and proportioned for 1-3-6 concrete. When concreting, an average of 75 cu. yd. was poured each day. All reinforcement for the floor and walls was hauled into the tunnel in the dump car and that for the roof in the concrete car. The culvert required 450 cu. yd. of concrete in all.

After the final pouring of the concrete and starting at a point where the concrete had had sufficient time for curing, short 8-in. by 16-in. posts were placed snugly between the 12-in. by 14-in. head timber and the top of the culvert roof on each side of each center post. The posts were then released and the holes in the roof and floor were filled with concrete. To remove the posts

they were cut off on an angle above the roof and cut square below it. This made it possible to raise the middle portion sufficiently to take out the lower piece in the floor and sufficient room was allowed when building the partitions to tilt the post enough to give plenty of space to take out the lower piece.

Unique Filling Method

Considerable study was given to the quickest and cheapest method of back filling the roof space after all tht concrete was poured and properly set. This back filling amounted to 500 cu. yd. of sand and to haul up the dirt and pack it, step by step, would take considerable time, while the labor cost would run rather high. To avoid this, the unique method was adopted of filling with sand poured in through pipes from the top of the embankment. Accordingly, 6-in. steel pipes were driven through the fill at intervals of 18 ft. and having a good substantial footing to work on, it was decided to drive the pipe lines upward through the roof of the tunnel, since to drive the pipe from above would have required a pile driver and that would have been more expensive.

Having only six feet of headroom to work in, all pipe sections were cut into 6-ft lengths, threaded at both ends. In driving the pipe the first procedure was to cut a square hole through one of the roof timbers to allow the entrance of the pipe into the fill. Then the pipe was jacked up into the fill with the help of a 50-ton Norton jack resting on the culvert top. The upper end of the first section of pipe was fitted with a wooden pilot made one inch larger in diameter than the diameter of the pipe itself so that, when driven through the fill, it would make a hole sufficiently large to allow the couplings of the pipe to pass through with as little friction as possible. One man could operate the jack readily except for the last 6 or 12 ft. of the first pipe line on each side of the track where the friction on 30 ft. of pipe was such as to require two men. As soon as the driving of each pipe was completed a wooden plug was inserted in the top to keep out foreign materials so as not to plug the pipe in any manner.

. Kaw river sand for the filling was delivered in drop bottom cars and unloaded into the pipe lines. For this purpose rough wooden chutes were built the full length of a car on each side of the track, tapering to a width of about 3 ft. over Holes 3 and 4. The filling was started in Holes 3 and 4, then going to 2 and 5 and finishing in Holes 1 and 6. When starting on Holes 1 and 6 the ends of the tunnel were filled and packed with earth to prevent the sand from washing out.

Water was used at intervals during the progress of filling for packing the sand. This was accomplished by running a pipe line from a steam pump to each of the holes and attaching a strong rubber hose which was lowered into the pipe to carry the water pressure well into the section being filled. After the filling was completed the top six-foot section of each pipe was taken out and the hole filled with earth. It required only six days to

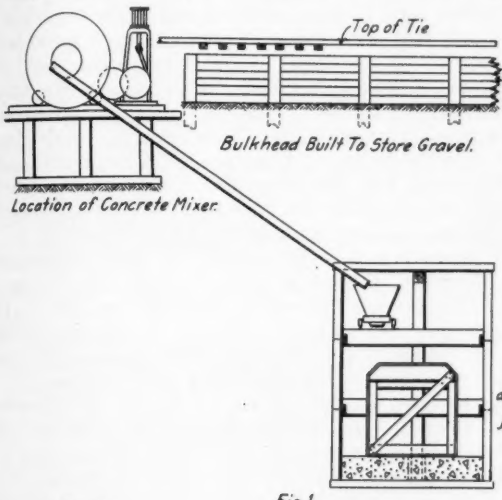


Fig. 1.

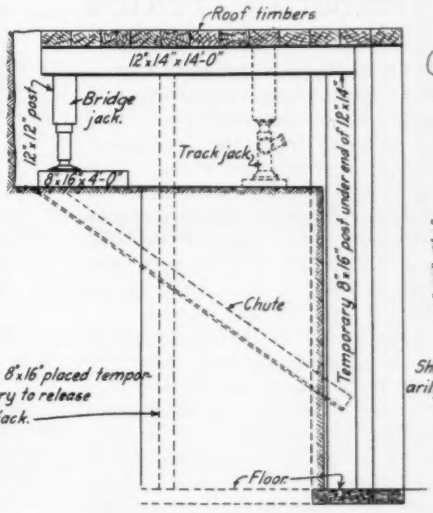
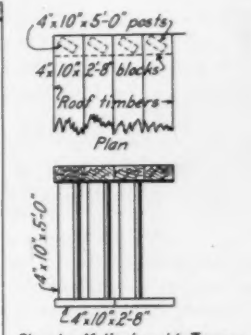


Fig. 3.



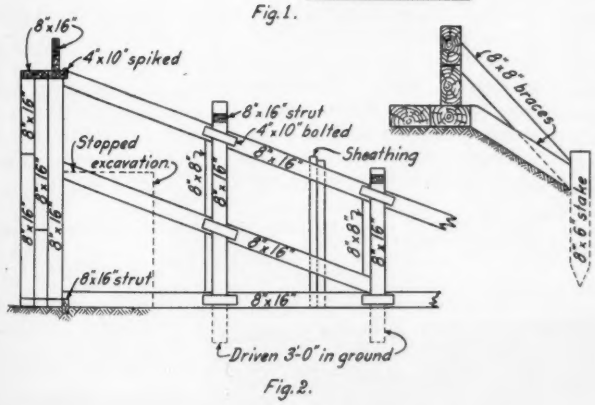


Fig. 2.

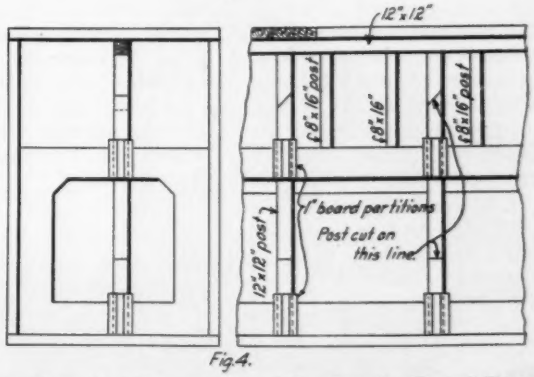


Fig. 4.

Fig. 1—How the Concrete Was Delivered to the Tunnel. Fig. 2—Method of Excavating and Bracing the Tunnel Portal. Fig. 3—Outline of the Tunneling Process. Fig. 4—How the Culvert Was Built Around the Tunnel Timbering, Showing Methods by Which the Center Posts Were Removed.

complete the filling, while to fill and pack by hand would have taken twice that time or even longer.

After completing the work it was found that the actual cost was substantially less than the estimate upon which the decision to adopt the tunneling method was based. This work was planned and directed under the general supervision of G. A. Haggander, bridge engineer, Chicago, Burlington & Quincy, and the writer. It was under the direct charge of P. E. Littles, master carpenter, and W. F. Bucknell, carpenter foreman of St. Joseph, Mo.

Showing Users How Timber Is Treated

THE holding of a conference of master carpenters and other officers responsible for the maintenance of timber structures at the treating plant was one measure adopted by the Philadelphia & Reading and the Central Railroad of New Jersey to drive home the importance of the proper handling of creosoted materials. This conference was held at the creosoting plant at Port Reading, N. J., during the winter, where opportunity was afforded not only for personal contact between those in charge of the treatment of the timber and the men who are responsible for its use, but also for the latter to see the conditions under which the timber was treated.

Among the features brought out in the discussion at this plant were the fact that cement or sand should be sprinkled over creosoted timber and particularly the bridge ties immediately after their erection to prevent their catching fire. Usually one application will be sufficient but it is essential that it should be applied on the first warm day in spring when the sun begins to draw the oil out of the timbers. The discussion developed the further point that practically all timber used out of doors and exposed to the atmosphere should be creosoted with the possible exception of planking on busy crossings or overhead bridges. It was further evident that the creosoting plant could frame more timber prior to treatment, eliminating the necessity of the bridge and building forces doing much hand work when the material arrives on the job and also avoiding the mutilation of the timber after treatment.

It Is Up to the Foreman

By William F. Knox
Section Foreman, Atchison, Topeka & Santa Fe, Fairvalley, Okla.

I THINK we foremen can well examine ourselves. How are we going to help the section laborer if we do not have "get-up" enough ourselves to show him just how his work should be done? I once worked under foreman who seemed to want me to direct his men, when I would have preferred that he take care of them himself. However, if the men are in my own gang I either work them or put them out. If the men want to learn and do their part it is up to the foreman to help them.

Why is it that we sometimes need two men to do one man's work? It is simply on account of this lack of supervision. I know that I have not always instructed my men as much as I should. It does not make any difference what a man's nationality is; if we have to work him, we should instruct him. When puting in ties a new man will often dig a hole six inches too deep. Time so spent is thrown away. The foreman who will keep his eyes open will see that this is not done a second time.

Once when I took over a gang, the roadmaster told me to discharge the whole gang and get another one. I said, "No I don't like to do business that way." If you treat your men right you will usually get along with them but when you cannot get along with them and they will not learn, you are better off without them.

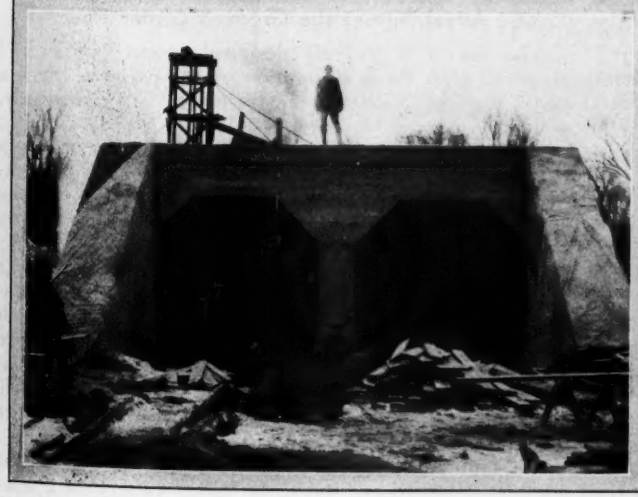
Some foremen work their men half to death by misdirected efforts. One of them told me he could not get any work out of his men. I took the same men, put in 225 ties, and one of the men said, "I don't see how we get so much more work done than with Ridgway, he made us dig down by the sides of the ties, take a hammer and knock them down in the hole and drag them out." This, of course, was work thrown away. I believe in a system for doing everything. If a foreman does not use some system he will not get anywhere. If the foremen will take pains with their men I believe we can accomplish more in the future than we have in the past.

*Abstract of a talk before a "Good Service" meeting at Amarillo, Tex., on December 11, 1923.

Master Carpenters and Division Engineers at the Port Reading Creosoting Plant

The Castleton Cut-off of the New York Central

This large project to provide a loop line around the city of Albany, N. Y., and eliminate the heavy grades involves an ultimate expenditure of about $20,000,000 and is now being prosecuted vigorously after a long delay in starting due to legal obstacles. It includes a large engine terminal and classification yard, a high level crossing of the Hudson river which, with the approach viaducts, is about one mile long, and about 20 miles of double-track connections with the Boston & Albany, the West Shore and the New York Central proper.



Laying Railway Tracks in City Streets

Modern Practice Utilizes Heavy Girder Rails and Concrete Base Construction For Best Results

OWING to the increasing necessity for better track and better paving, brought about by the heavier wheel loads and more dense traffic of both railways and motor trucks, many new problems have arisen in the design and satisfactory installation of railway tracks in city streets. In the solution of these problems, the use of girder rails of heavy section and a marked permanence of construction have resulted in installations which are both satisfactory and economical over long periods. As the city of Philadelphia, Pa., has more of this class of railway trackage than most other cities, the following discussion of the problems of girder rail construction and description of what the Pennsylvania, the Baltimore & Ohio and the city are doing along Delaware avenue on the Philadelphia waterfront, should be of direct interest to all maintenance men.

One of the most important railroad problems in meeting the present day competition of the motor truck is that of bringing the railroad nearer to the actual loading point of the shipper. While large industries on the outskirts of a city usually have their own sidings, in order to reach much of the city's business it becomes necessary, in a large number of instances, to bring the railroad into the city itself. This is especially true at rail-to-rail or water-to-rail transfer points. It is often impractical to bring the railroad in over an elevated structure or through a subway, so that the necessity arises for laying tracks through paved streets. The heavier wheel loads and the deeper flanges of steam road equipment merely serve to augment the difficulties of construction and maintenance common to the experience of the street railway engineer.

Greater Permanence Necessary

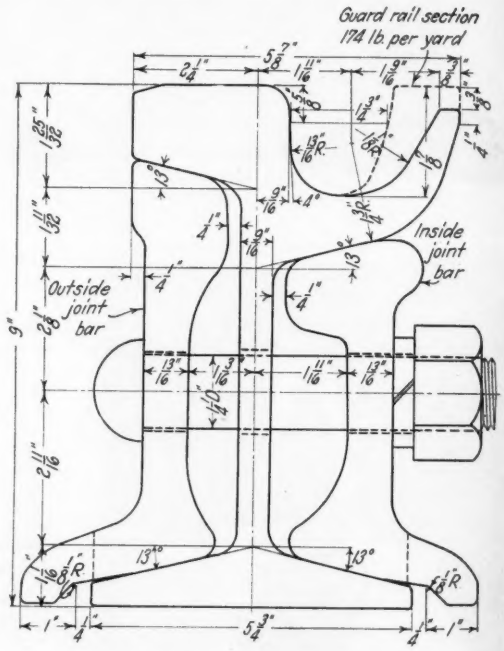
When installing tracks in paved streets it is necessary to build for greater permanence than is the case with open track construction, for ties cannot be tamped or track resurfaced at the convenience of the maintenance force. It is a common sight to see pavement slump so that the ties can be counted by the ridges in the street surface. Whenever the pavement fails there is no remedy without going to the expense of repaving. It is, therefore, evident that a greater first cost is warranted in order to obtain a permanent job. The whole question of rails, the number and style of joints, the number and kind of ties, the type of paving, etc., must be considered carefully and the necessary changes made in the usual open track type of construction to insure the desired result.

Considering the problem in this light, the first question which should be considered is the design of rail best adapted to this work. Standard tee rail sections have a usual depth of 5 to 6 in. This does not locate the tie a sufficient distance below the top of the rail to permit the most modern paving practice, and further, the paving can not be laid against the head of the rail as flangeways must be provided. Under the heavy trucking traffic usually found at freight terminals and docks a paving of unusual durability is required which necessitates a depth of not less than nine inches.

Various methods have been tried to secure this depth with standard tee rail through the use of chairs or stringers. These devices have the disadvantage of locating the base of the rail at a point about midway in the paving depth, which makes it difficult to pave close to the head of the rail, a point where good paving is especially required.

It has further been found necessary to use metal flangeways of some sort to provide a uniform depth of flangeway and to protect the paving at this point from the serious effects of vehicular traffic. To accomplish this various schemes of bolted-on guards have been tried.

None of these various combinations to secure proper depth and a protected flangeway have proven entirely



Details of the Grooved Girder Rail

satisfactory. The many parts required increase the cost of installation and subsequent maintenance expense, and still do not give the desired result.

Advantage of the Grooved Girder Rail

The use of a properly designed grooved girder rail seems to offer the best solution of the problem. Such a rail 9 in. deep, with a metal flangeway rolled integrally, combines in one piece the required elements with the minimum amount of metal and the increased strength inherent in the unit structure. By thus reducing the number of parts to a minimum the first cost is usually lowered and the subsequent maintenance expense greatly decreased. The nine inch depth not only allows for proper paving, but gives unusual beam strength to the rail. This increased depth, together with the lateral support afforded by the pavement, increases the strength and stiffness of joints, thus reducing to a minimum one of the common sources of trouble. By the use of inexpensive tie rods, spaced about six feet apart, the whole is bound together, making a solid job even when the ties are rotted away.

The integrally-rolled metal flangeway is one of the important features of the girder rail. As it is not a sepa-

Six Stages in the Construction

A Turnout Ready for Concreting
Ready for the Paving

The Concrete Being Placed
Laying the Paving Blocks

The Finished Street

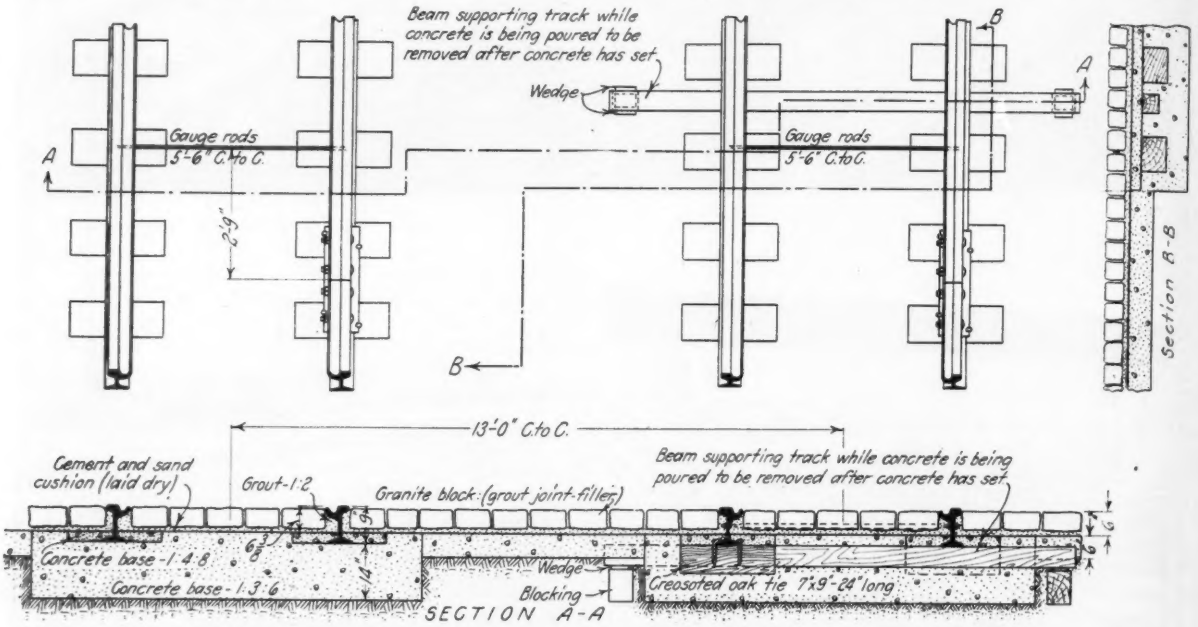
rate attachment, it can not come loose, and so affords a firm, straight edge against which to lay the paving. Any side wear from flanges of loose wheels, etc., is borne by this metal guard, which also fully protects the pavement from the wheels of vehicles constantly crossing the tracks or running along in the flangeways. It is not possible for dirt or snow to become jammed in the flangeways and cause trouble such as is often experienced when a rail is set on edge or another makeshift flangeway is used.

The common rails of this type are the 9-in. grooved girder, weighing 159 lb. to the yd., for straight track and the girder guard weighing 174 lb. to the yd., for curved track. These sections are developments of the earlier 9-in. sections weighing 141 lb. per yd.

The use of paving, of course, precludes the use of ordinary split switches, therefore, tongue switches and mates are almost invariably supplied for layouts. Occasionally double tongue switches are installed, instead of the usual tongue switch and mate construction.

The former method of laying girder rail tracks in the city streets consisted of placing ties of standard length on a concrete slab construction and ballasting with rock which was used also between and up to the top of the ties and thoroughly compacted. One-inch yellow pine boards were then spiked longitudinally to the ties to support a gravel foundation for the granite block street paving. The present design and method of installation departs somewhat from the preceding plan in that the use of ballast is dispensed with and the use of timber is restricted to a minimum.

For the track structure, 9-in., 159-lb. grooved girder rails were used for the straight tracks and 9-in., 174-lb. girder guard rails for the curved tracks. These are Sections 159-517 and 173-518 as rolled by the Lorain Steel Co. and Sections 408 and 409 as rolled by the Bethlehem Steel Company, respectively. On curves and through turnouts and crossovers treated oak ties of special lengths were used in conjunction with a shouldered tie-plate measuring 11/16 in. by 7 in. by 10¾ in. On tangent track, however, the rails were spiked directly to treated oak tie blocks, 7 in. by 9 in. by 24 in. in dimension. The tie blocks and ties are spaced 18 to a 33 ft. rail length and the entire track structure on curves and tangents thoroughly braced by means of ⅜ in. by 2¾ in. tie rods, installed at intervals of 5 ft. 6 in.



Details of the Construction of the Girder Rail Track in Stone Pavement

Scope of the Work

The Delaware avenue work, or South Philadelphia improvement as it is sometimes called, consists, at the present time, of about three-quarters of a mile of four-track construction, street widening and paving. It extends between Snyder avenue and Bigler street. Between these limits, Delaware avenue will be widened to 200 ft. from Snyder avenue to Porter and to 250 ft. between Porter and Bigler. Taken as a whole, the South Philadelphia improvement work involves a total of about six miles of track changes and has been under way for a number of years. Originally this waterfront thoroughfare was a 58-ft. street, serving both the waterfront facilities such as piers, etc., and the industries in this territory. Subsequent growth in facilities and traffic rendered this a severely congested avenue and led to the development of this street widening and improved railway track program. Approximately all of the section not included in the present work has been repaved within the last three years in conjunction with the installation of heavy girder rail of 159 lb. section.

The Track Foundation

The chief feature of interest in the Delaware avenue installation is the design of the track foundation and the method by which it was constructed. This foundation is entirely of concrete over and between the ties and to a depth of 7-in. below, giving both a rigid track structure and an equally solid and firm base for the street paving. Following the usual sub-grading and the laying of the street, the track was raised in sections to approximately the required grade and supported at that elevation by means of cross girders which were generally pieces of old rails resting on wood blocks and oak wedges, set up on both sides of the track at intervals of about 8 ft. The track was then surfaced accurately by driving the wedges in or out and then lined by sliding

it on the cross beams, a clear sight being easily obtainable since the top of the rails remained unobstructed.

Forms were then placed for the concrete and a 1-3-6 mix poured in, around and under the ties, to a depth of 7 in. below the bottom of the ties and to a distance of 9 in. beyond the ends of the ties or tie blocks. As soon as this concrete had set sufficiently to permit the removal of the cross beams, an additional amount of the 1-3-6 mix was poured in and around the ties and brought up to a height of 2⅝ in. above the level of the top of the ties, additional forms being used to prevent any concrete of the 1:3:6: mix from being poured on the ties or tie blocks for a distance of 12 in. from the rail. This 24 in. space over the ties and along the rail was then filed with a 1:4:8 mix which is easier to remove in case of rail renewals, etc. At turnouts and crossovers the entire area included between the extremes of the tongue switch and the frog were poured with the 1:4:8 mix above the level of the tops of the ties.

In either type of construction the tie blocks and ties are completely embedded in concrete, the maximum depth of which is 16⅝ in. The inter-track spaces are taken care of by pouring a 6-in. concrete slab of the 1:3:6 mix on a foundation of well compacted cinders. The upper surface of this slab corresponds to the upper surface of the concrete in the track structure. The paving for the street surface consists of granite paving blocks 5-in. thick laid perpendicular to the center line of the track and ⅜ in. below the top of the rail, on a one-inch sand cushion with which some cement has been mixed. All spaces between the paving blocks and between the blocks and the rail are well grouted, thus binding the pavement solidly together.

This work is being carried out under the direction and supervision of the railroads involved and the City of Philadelphia; C. W. Thorn, assistant engineer of construction, Pennsylvania System, and J. W. Phillips, division engineer, Bureau of Surveys, City of Philadelphia. J. H. Fitzsimmons, Pennsylvania System, is in charge of the field work, with L. W. Pilot, general foreman, as inspector on the work. The contractor is John Meehan & Son, Philadelphia.

Section Men Killed in Derailment of Snow Plow

TWO section men were killed on February 10 as the result of a derailment of a snow plow on the Pennsylvania railroad at Kingsley, Mich. As reported by the Bureau of Safety of the Interstate Commerce Commission, this accident occurred on a single track branch line extending from Walton Junction to Traverse City, Mich., where the plow was engaged in removing snow from the track. The derailment occurred opposite the station at Kingsley while the work train, consisting of the plow, caboose and engine, were traveling at a speed estimated to have been between 15 and 20 miles an hour. The plow was derailed and completely demolished, affording the two section men occupied in operating the wings of the plow no opportunity of escape. Measurements made after the derailment showed that there was a bank of snow 32 in. west of the track on the derailment side about three feet in height which had been formed by previous plowing in this vicinity. Just outside of the rail the snow was level with the top of the rail, from which point it rose gradually to a height of about four inches, where the bank of snow began. It was concluded that the accident was caused by ice and snow packed on this side of the track, the result of which was to raise the wing of the snow plow on that side and the nose of the plow, thus allowing the wheels to mount the rail.

Painting Elevated Tanks*

THE WAY to obtain maximum service from an elevated steel tank is to paint it often enough to keep the steel from deteriorating due to action of water inside and the weather outside.

To insure the maximum service from a tank re-paint it periodically at intervals of about four years. Paint it both inside and out, and when you paint it be sure of two essentials: (a) that you use good paint, and (b) that the paint is properly applied.

We cannot recommend any particular paint because this is a very moot question. All we can say is, "Use a good paint." When you buy your paints the paint salesman will tell you about the various grades of paint which are available for your uses and assist you in making a selection.

Must Be Properly Applied

Of more importance than the grade of paint is the way in which the paint is applied. You can easily determine how the painting should be done if you stop to consider why the tank is painted. The painting is for the purpose of covering the steel in such a manner as to keep rust-inducing elements and compounds from coming in contact with it.

Old paint should be cleaned off before the new paint is put on. The best way to do this is to sandblast the tank and bring the surface down to clean steel. If this is done and the paint is applied evenly and as soon as possible after sandblasting, you may rest easily for several years to come and probably for more than the four years recommended above as the proper interval between paintings.

Sandblasting is not always necessary. If the existing paint adheres firmly except for small and infrequent blisters and patches, you may by thoroughly wire-brushing and scraping over the tank bring the surface to the degree which will permit the new coat of paint to adhere. In wire-brushing and scraping be sure to take off *all* of the paint which is not firmly adhering to the steel.

Places to Watch

At the inside of and near the top of the tank shell, the rising and lowering of water, subjecting the steel alternately to emersion in water and exposure to air, may wear off the paint faster than at other parts of the tank. Therefore, pay particular attention to this area. Possibly you should paint this particular part at more frequent intervals than the outside of the structure. Don't take your painter's word for this. You, yourself, can well afford the time to inspect the inside of the upper shell rings.

Tower details also should be most carefully scraped and brushed—if not sandblasted—and then most carefully painted.

Human Element Most Important

This brings us to the most important statement in this brief exposition. The reason why paints fail to protect is due more often to the way painting is done than to the paint itself. Just as a chain is no stronger than its weakest link, a painting job is no better than the painter. Careless scraping and brushing of the surface; too hasty application of the paint; too thin a coat; too little attention paid to painting tower details—these are the things that you will have to guard against.

*Abstracted from the April, 1924 issue of the Water Tower, published by the Chicago Bridge & Iron Works, Chicago.

Gardens, Safety Records and Homes Figure in S. P. Inspection

IN conducting the annual inspection on the Southern Pacific, not only is the right-of-way and roadbed on every foot of main and branch lines examined and rated but a measure is also taken of the condition and appearance, inside and out, of every section house, tool house, pump house and fuel oil station, of the grounds around every station, of every office, of the pumper's homes, the B. and B. material yards, the signal towers and every other facility. A measure is also taken of the record of every foreman for safety. It has come to be a practice on a large number of roads to put the upkeep of its track upon a competitive basis, but few roads pursue as comprehensive a program of inspection as the one in question.

While each grand division of the Southern Pacific system has its own system of inspection, these inspections are enough alike to be described together. Each section is graded on the basis of 100 points, divided as follows: 25 points for perfect alinement, surface and gage; 25 points for spiking, ties, lining and spacing, switches and frogs; 20 points for drainage and ballast; 10 points for material, grass and weeds, right-of-way; 10 points for section houses and grounds; five points for sidings and five points for road crossings, runoffs and fencing. For purposes of comparison, branch lines are classified separately from main lines. Similar to the method of grading the section houses and grounds, all other buildings are graded on the basis of 10 points as a perfect score, although the record of these scores is kept separate from the records pertaining to the records covering the condition of track.

Prizes are awarded to the foreman of each section having the best average on a roadmaster's district and to the foreman and roadmaster having the best average on the grand division. On the Texas and Louisiana lines, $100 is awarded to the foreman having the best average on each district; $75 to the foreman having the second best average, and $50 to the foreman having the third best average; while on the Pacific System a gold medal is awarded to the roadmaster having the best district and silver medals to the section foremen having the best averages on each district. In addition, an efficiency prize consisting of $100 in cash and a system annual pass for himself and family is awarded to the foreman showing the best efficiency record on each district, as determined by his performance during the year as distinguished from markings received on the inspection. On the Pacific System silver medals are also awarded to pumpers, station masters, and others who receive perfect scores for the buildings under their care.

When all the returns are in an itemized report of the inspection is published in a pocket size booklet for general circulation. This booklet gives the itemized and average record of each section and district. The general averages of the different divisions are also given with the averages received by the different roadmasters. In addition, a list of all prize winners is given together with a list of all facilities receiving a perfect score. Photographs are included of the prize winning sections as well as certain of the prize winning facilities. In the booklets are also published the names of maintenance of way and mechanical department foremen who conducted their work throughout the entire year without the occurrence of a single casualty of a reportable character to any member of their forces.

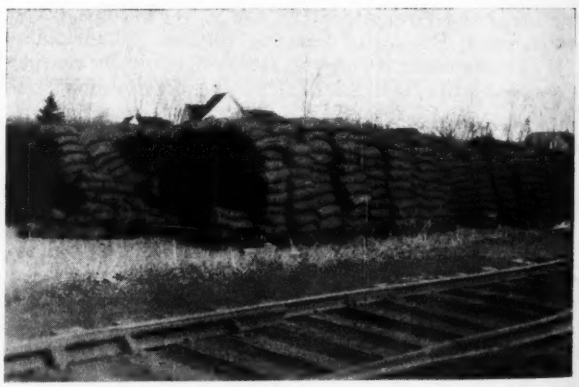
The winners of the gold medals on the Pacific System this year are: S. R. Cupples, roadmaster of the San Jose district of the Coast division, and Gust Dimotsis, foreman on the Suisun district of the Western division. Mr. Dimotsis also received one of the 49 efficiency prizes awarded for the character of work done throughout the year and has the distinction of having received silver medals on five previous years. To E. W. Suess, a foreman on the Stockton division of the Stockton district, went the honor of having the highest score for efficiency throughout the year.

On the lines composing the Atlantic System P. P. Marion, roadmaster of the El Paso district of the El Paso division, had the best main line average among the roadmasters, and R. M. Perdue, roadmaster of the Ennis district on the Dallas division, the best branch line average. The section foreman having the highest average was H. F. Hilley, of the El Paso division. The Pacific and the Atlantic divisions each had 46 perfect pumphouses, while perfect scores were given to nearly 100 section houses on the Atlantic System.

Northern Pacific Treats All Tie Plugs

ONE little tie plug does not cut much of a figure in the operation of a railroad, but when 6,000 sacks, each containing 1,000 of these articles, are stacked together the result is a pile of healthy proportions, representing a lot of work in their preparation and constituting an item of expenditure not altogether insignificant in a railroad's accounts.

The accompanying illustration shows such a pile at Brainerd, Minn., on the Northern Pacific, where 6,000,000 tie plugs were recently piled in readiness for distribution along the railroad shortly after their treatment in the wood preservation plant at that point.



The Season's Supply of Tie Plugs for the Northern Pacific

The treating of these plugs is now the established practice on the Northern Pacific. With the adoption of this practice it has also become customary on the Northern Pacific when relaying rail to apply one or two coats of hot creosote to the exposed untreated wood of ties which it is necessary to adze to give the new rail a uniform bearing. Section gangs are also furnished with sufficient creosote so that all ties which they find it necessary to adze from time to time may also receive an application of creosote before placing the tie plates. In such cases the treatment is made by brush application. These practices have been developed at the suggestion of Andrew Gibson, superintendent of tie and timber preservation, to whom we are indebted for this information.

Responsibility of Maintenance Forces for Accidents Looms Large

Heavy Toll Suffered in or Chargeable to This Department a Challenge to Every Reckless Workman

RAILWAY ACCIDENTS cost 6,325 persons their lives and more or less seriously injured 134,871 other persons during 1922, according to the statistics of the Interstate Commerce Commission for that year. This is at the rate of more than 18 deaths and 373 casualties a day and represents an increase of 329 over the number of deaths in the preceding year. Of the dead, 1,657 were employees, while the injured employees numbered 117,197, or 85 per cent of the persons suffering non-fatal injuries. The accidents reported cost the railroads $22,868,540 in property damage resulting from wrecks associated with some of the accidents and the cost of cleaning up these wrecks.

One-Third of All Employee Accidents Suffered by Maintenance Forces

It is not generally appreciated that a large percentage of the casualties that occur on railways are suffered by employees in the maintenance of way department. That such is the case, however, is clearly brought out by these reports of the Interstate Commerce Commission, which show that on the Class I roads (which represent 90 per cent of the total mileage) 428 employees of this department were killed and 22,538 employees were injured in 1922. In other words, 28 per cent of all the employees killed on Class I railroads in 1922 and almost 20 per cent of those sustaining injury of a reportable character were engaged in the maintenance of way and structures. The accompanying table shows the distribution of these casualties, according to the class of workmen.

Accidents to Maintenance Employees on Class I Roads

Class of Person	Train, train-service and-non-train accidents* Killed	Injured	Non-train accidents Killed	Injured
Roadmasters, general foremen and inspectors	2	123	...	113
B. & B. Foremen	4	145	3	137
Carpenters	33	2,298	24	2,267
B. & B. Ironworkers, painters, etc.	7	427	4	414
B. & B. Helpers and Apprentices	9	577	8	565
Portable Steam Operators	8	161	2	132
Pumpers	3	135	3	133
Track Foremen	39	1,020	10	959
Track Labor	288	16,697	71	16,049
Signal and Electrical Forces	35	955	18	905
Total	428	22,538	143	21,674

*Train accidents comprise all accidents arising in connection with the movement of cars, etc., causing at least $150 damage to railway property, including cost of clearing wrecks. All other accidents in connection with the movement of cars, which cause reportable injuries, are train service accidents.

It will be seen from this table that the heaviest casualties occurred among the track laborers where the deaths on the Class I roads amounted to 288, or 67 per cent of the total for these roads, while the injuries amounted to 16,697 or 74 per cent of the total number of injuries sustained. Next to the section laborers come the bridge and building carpenters with 33 deaths and 2,298 injuries.

Further examination of the table shows that the majority of all accidents involving employees in this department are non-train accidents (that is, accidents not arising in connection with the movement of trains). Thus 21,817, or 90 per cent of the 22,966 casualties involving maintenance of way employees of the Class I railroads in 1922 were non-train casualties. This number amounts to 26 per cent of all of the non-train casualties among all employees of the Class I railroads. Also 285, or more than 65 per cent of all the maintenance employees killed on the Class I railroads were killed in accidents connected with the movement of trains, rather than in non-train accidents and 217, or 75 per cent of the 288 section laborers killed met their death from this cause rather than from non-train causes.

Faulty Maintenance Causes 2,734 Train Accidents

In 1922 there were 2,734 accidents to trains of a character to cause $150 or more damage to property which were caused altogether by defects in or improper maintenance of way and structures. These accidents resulted in 25 deaths and 748 injuries, in addition to a property loss of $2,558,520. These accidents were almost entirely derailments, of which there were 2,719, representing 20 per cent of the total number of derailments from all causes. There were also 12 collisions attributable to this cause. The analysis of those accidents, which were found to have been caused altogether by defective or improper maintenance of way and structures is furnished in the accompanying table.

Accidents from Faulty Maintenance

Cause	Accidents	Dead	Injured
Bridges, defects in structure or upkeep	7	1	6
Ties, decayed or otherwise defective	368	...	11
Tie plates, broken or otherwise defective	2	...	1
Other defects in ties and plates	8	...	...
Total—Ties and tie plates	378	...	12
Broken rail	561	3	310
Crushed head and split head or web	31	1	30
Rails, spreading, improperly spiked or braced, joints loosely or improperly bolted, etc.	173	2	35
Rails, giving away or causing accidents because of worn condition, rail joints broken or otherwise defective	85	...	3
Other defects	19	...	...
Total—Rails and joints	869	6	378
Frog bolts or springs defective or missing	23	...	...
Frog guard rail or fastenings defective	67	...	4
Frog wing rails or points broken	20	...	1
Other defects in frogs	48	...	1
Switch points, bent, broken or worn	176	...	29
Switch stand or parts loose, broken or defective	176	3	56
Keeper or latch broken, defective or missing	19	...	1
Electric or interlocking parts	13	1	3
Switch, spiked, working loose	13	...	1
Other defects in or improper maintenance	30	1	1
Total—Frogs and switches	585	5	97

	Accidents	Dead	Injured
Guard rail, improperly placed or secured	14	2	2
Insufficient, excessive or uneven superelevation	127	...	4
Improper alinement	97	...	102
Improper surface	216	5	24
Low joints	108	1	33
Track settling	25	1	1
Insufficient ballast	4	1	...
Gage, improper	49	1	14
Excessive curvature	22	...	...
Soft track	185	2	63
Other miscellaneous defects or improper maintenance	42	...	10
Total	889	13	253
Grand Total	2,728	25	746

From a study of these figures it is seen that the largest single cause of these accidents, both in the number of accidents and the number of casualties suffered, was broken rails, which led to 561 accidents and 310 injuries. Next to broken rails come decayed and worn ties, which caused 328 accidents, while improper surface of track rates third with 216 accidents to its account.

Washed Roadbed Causes 15 Deaths and 64 Injuries

In addition to those instances where train accidents occurred altogether from some defect in or improper maintenance of way or structure there are various other accidents where the maintenance department is directly or indirectly interested or involved. The more prominent of these are incorporated in the following table.

Other Train Accidents Involving Maintenance Department

Cause	Accidents	Dead	Injured
Negligence of employees, failure to put out slow flag	13	1	6
Obstructions placed on tracks	14	1	20
Switches tampered with	105	11	62
Tracks tampered with	11	7	44
Incendiarism	1	...	...
Total malicious acts	131	19	126
Bridges, etc., damaged by rain or floods, etc.	8	2	39
Roadbed damaged by rain or floods, etc.	63	15	64
Bridges damaged by accidental fires	6	3	2
Animals on track	22	2	11
Switch or frog, obstacles in	36	...	12
Landslides, boulders, etc.	75	5	37
Snow or ice on tracks	88	5	18
Worn flange and worn switch point, combination	79	...	6
Improper side bearing clearance and irregular surface of track, combination	35	...	...
Improper side bearing clearance and improper superelevation of track, combination	7	...	...
Improper loading of cars and irregularities in track, combination	48	...	...
Probable defects in or improper maintenance of way and structures	38	...	10
Total miscellaneous causes	644	52	331
Total accidents in whole or part from faulty maintenance	2,935	25	754
Total train accidents involving maintenance	3,516	97	1,209

Striking Fixed Structures Causes 82 Deaths

Many of the accidents for which the maintenance of way forces were wholly or partly to blame or at least interested, also resulted in casualties to employees in train service, passengers, etc., as well as to employees engaged in maintenance of way work. Among such accidents are those resulting to persons coming in contact with fixed structures while on moving cars or locomotives, as a result of which 66 persons were killed in 1922 and 806 others injured more or less seriously, from this cause. The specific nature of these accidents is shown in the accompanying table.

Accidents from Striking Fixed Structures

Cause	Killed	Injured
Bridges	34	203
Buildings or gates	3	73
Coal chutes, aprons, docks, elevators, etc.	6	29
Enginehouse or roundhouse doors or doorways	2	3
Fences, cattle guards, etc.	2	24
Mail cranes	2	31
Overhang at stations and other buildings	..	15
Platforms	5	27
Poles	1	44
Stock chutes or pens	..	18
Switch stands, lamps, targets, etc.	4	161
Tunnels and snow sheds	..	10
Water and fuel-oil spouts	2	54
Wires or pipes, overhead	4	56
Other fixed structures	1	58
Total	66	806

In addition to the above accidents, which involves only collisions with fixed structures while persons were on moving cars and locomotives, collisions with fixed structures while persons were in the act of getting on or off cars or locomotives, resulted in 16 deaths and 84 other reportable casualties; also persons caught between locomotives or cars and fixed structures while not engaged in riding or in getting on or off trains, resulted in 8 deaths and 46 injuries. When considered together, 90 persons were killed and 1,021 injured as a result of coming in contact with fixed structures.

Trains Striking Motor Cars Kill 34

Other train service accidents involving the maintenance of way department include several caused by persons falling off or through bridges, trestles or culverts not equipped with hand rails or foot walks. These accidents resulted in 5 deaths and 39 injuries, chiefly employees in train service, and may be enlarged by adding 3 deaths and 77 injuries at bridges where no mention is made of the presence of hand rails or foot walks when assigning the cause. There were 566 persons, chiefly employees in train service, injured from stepping or tripping on coal, boards, stones, rubbish or other loose or refuse material, or in holes and a total of 366 persons, also chiefly train service employees, sustained injuries by stepping or tripping on ties, rails, ballast, etc. A total of 59 injuries were sustained from falling over material, lumber, ties, rails, etc., 140 injuries from falling or tripping over air or steam lines, switch rods or levers, etc., and 24 injuries suffered as a consequence of tripping or falling on defective station platforms. Collisions between hand and motor cars and trains resulted in 34 deaths and 157 injuries, of which 26 deaths and 137 of the other casualties were suffered by roadway forces.

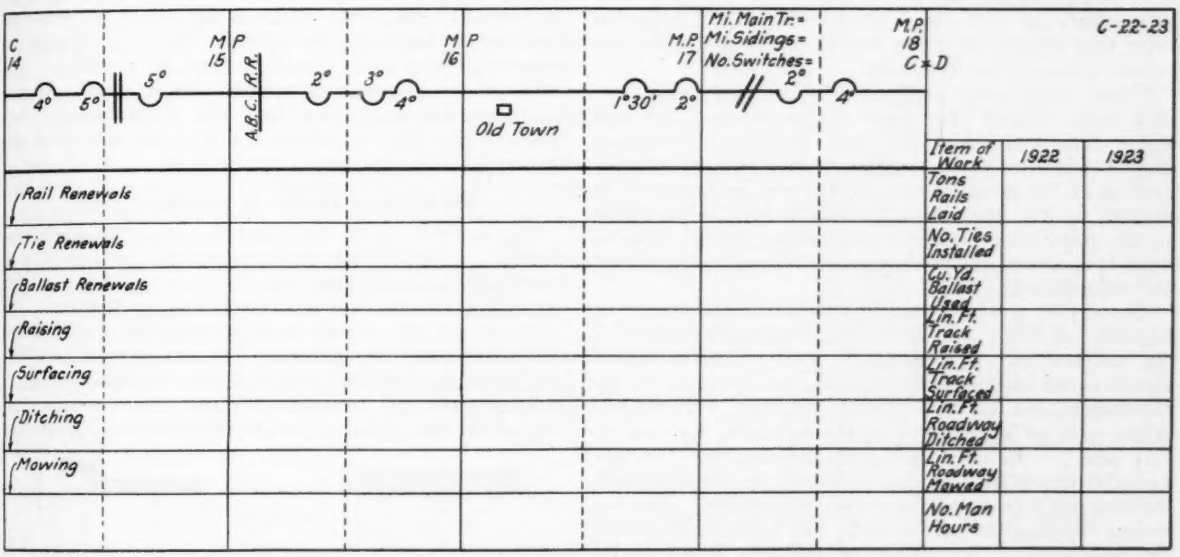
STRIKE DAMAGE HEAVY—A digest of the evidence gathered by the Department of Justice and other public agencies relating to the strike of railway shop employees begun on July 1, 1922, shows the total cost of the strike on the 50 railroads from which testimony was taken, amounted to $96,501,376, including only the cost paid out, as distinguished from loss by damage to property, loss of business incurred, etc.

Developing a Section Progress Chart

By Charles Weiss

PROGRESS CHARTS and graphs to show results for any given period as well as the cumulative performance in relation to seasonal programs are in fairly general use. However, the subject has usually been considered from the point of view of an entire division or at least a supervisor's sub-division. While it would seem that each section might well be considered a problem in itself.

The simplest progress chart would consist of a straight line diagram of the tracks, drawn to some convenient scale, with other parallel lines to show the different major operations, such as rail, tie and ballast renewals, track raised, etc. The scheduled and the completed work are shown on the original line with different colors in either ink or crayon. A tracing may be made of the entire division, and after prints have been made they should be cut into strips, each representing a complete track section. Only important physical characteristics which influence the work should be shown, and enough vertical lines produced to bring the different parts in clear relief on all of the horizontal lines. The scale will depend upon the nature of the property but should be uniform for the entire division. Where there are multiple tracks with many features, a scale of one inch per quarter mile is convenient, whereas one inch per mile will be satisfactory for an unimportant single-track line.



A Blank Form for the Chart

Use Different Color Schemes

Such a chart will make it possible to show the results obtained for a period of from two to four years. The same piece of track is rarely gone over thoroughly in less than that time and thus the coloring would not overlap. A different color scheme should, however, be used for each year. Thus yellow may represent what is to be done during the first year and red what has been finished. Items that are carried over uncompleted from one year to the next may be indicated by a broken line of the color for that year.

Having prepared the blank chart the supervisor or roadmaster should walk over the section with the foreman in charge who has been notified previously to be ready to explain his own program. If walking is out of the question the foreman fills out the print and the supervisor may check it by riding over the section. As they walk the track, a notation is made of the work required on each curve or tangent. The condition of the rail, ties and ballast are discussed as well as the drainage and track conditions. The foreman speaks with a direct knowledge of the work he has done, while the supervisor makes the final decision, based on the foreman's recommendation, his own observation of the riding qualities of the track and his estimated allotment of men and materials.

Incidentally the supervisor is enabled to get a fair estimate of his actual tie and ballast requirements. He also notes the amount of rail needed as well as the comparative condition of each stretch to be replaced. As the new rail comes in, he lays it at the different places in the order decided upon. The tie renewals decided on when walking over the track must also be modified during the season by the actual allotments. Work carried over from a previous season will naturally have the first preference.

When the Program Is Completed

When the program has been completed and shown on the chart a copy should be sent to the foreman. The completed items are then recorded very simply in one of several ways. If each kind of work has been classified according to the order in which it is to be carried out, the foreman reports ties renewed, item No. 1, June 15, 450 W. O. No. 5 used. This means that on June 15 he completed the tie renewals in the stretch which was to have been completed first on his section. When that information is shown on the office chart the notation "450" can be written close to the line. In this manner the chart shows an accurate as well as a geographic record of the work done. Another procedure is for the supervisor or some subordinate to keep the chart up to date by observations of what is being done on trips over the road, supplemented by talking with the foremen. The first method is the most simple. Neither one, however, requires as much time as one might be inclined to think.

The same chart also offers a concise statement of the work done on a section annually. A space about two or three inches is left at the right of the chart proper, in

which is written the summary of each operation for the year as well as the cumulative amount for the life of the chart. If desired such other information as the miles of main tracks, sidings, and the number of switches can be shown there as well as a statement of the number of man hours for the year. All of this information is known and requires only the time necessary to record.

The charts may be kept together geographically in some sort of a book. The sheets for any one section should be kept together with a notation in the upper right hand corner, such as "B—20-21," meaning that it is the chart for section "B" for the years 1920 and 1921. It will then be very handy for reference and become one of the most frequently consulted records in the office.

Shape of Entrance Affects Flow Through Culvert Pipe

RAILWAY engineers, as a rule, have not given much thought to the relative hydraulic efficiency of different types or designs of culverts or to the effect which the form of the end walls and wings exert on this factor. However, from the results of tests conducted by the U. S. Bureau of Public Roads in co-operation with the University of Iowa, it would seem that greater attention should be given to this particular phase of culvert design.

These experiments covered concrete pipe with beveled ends, vitrified clay pipe of the standard bell and spigot type and corrugated pipe and were concerned largely with the determination of the relative friction factors of the three types. As this will be discussed in another article, the matter presented here is restricted to the conclusions reached with respect to the relative head loss due to entrance and the influence of gradient and submergence.

The report was designed primarily for the benefit of highway engineers and, therefore, deals extensively with the vitrified clay pipe which is used to but a limited extent under railway embankments, but inasmuch as the experiments did not cover the concrete pipe with bell and spigot ends so largely used by the railroads, the data on clay pipe are included here with the idea that they are fairly representative of the results to be obtained with the concrete pipe that have similar end details. The following information on the tests was taken from an article appearing in the Journal of Highway Research for March, 1924.

The quantity of water a culvert will discharge is directly proportional to the square root of the head and bears no relation to the grade at which the pipe is laid, if the pipe flows full, as it should at maximum capacity. The water in a pipe culvert under these conditions does not act as does that flowing in an open ditch where the quantity of discharge is dependent upon the slope or grade of the water surface in the ditch, but, as is the case with any pipe flowing full, the discharge depends upon the water pressure available to force the water through the opening and the pipe. In the case of a culvert the water pressure which causes discharge is that furnished by the difference between the water levels at entrance and outlet. The depth of submergence has no effect on the discharge so long as the difference of the water levels at the two ends of the culvert remains the same.

Another outstanding observation is that the head loss at the culvert entrance is an important factor in determining the discharge and varies greatly with the type of entrance used. The data on the effect of different types of entrance on the entrance loss are among the most interesting of the findings from the tests.

For a square-cornered entrance the average entrance loss coefficient is found to be 0.393. Text books on hydraulics give the coefficient for a square-cornered entrance as 0.50.

Table 1.—Dimensions of Concrete Pipe

A	B	C	D	E
Inches	Feet	Feet	Feet	Feet
12	0.167	0.13	0.06	0.05
18	.23	.21	.06	.06
24	.25	.21	.06	.08
30	.29	.25	.09	.10

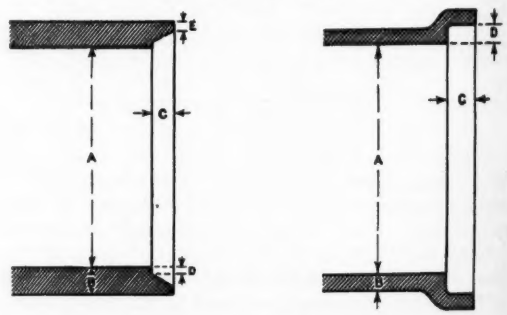
Table 2.—Dimensions of Vitrified Clay Pipe

A	B	C	D
Inches	Feet	Feet	Feet
12	0.09	0.20	0.12
18	.11	.24	.15
24	.13	.28	.18
30	.20	.34	.29

Methods of Reducing Entrance Loss

The beveled lip on the concrete pipe shown in the drawing, assists greatly in reducing the entrance loss at a straight end wall entrance, the average entrance loss coefficient for all sizes and lengths being 0.099.

A bell end pipe culvert with the same form of straight end wall is especially efficient. The average entrance loss coefficient for the bell pipe is 0.063. By taking care to make a gradually rounded entrance, this entrance loss can always be reduced practically to zero. When the bell is filled with concrete shaped in the form of an ellipse, the coefficient becomes 0.020.



End Details of the Pipes Used in the Tests

Special conical entrances tested did not prove as efficient as the bell end of a pipe in reducing the entrance loss, although they assist greatly in reducing the entrance loss into a corrugated metal pipe. The average entrance loss coefficient for the various conical entrances is 0.088 whereas for the bell this coefficient is 0.063. The average entrance loss coefficient for the various conical entrances used in connection with corrugated metal pipe is 0.044, whereas for the regular end of a metal pipe this coefficient is 0.226. There is little difference in the effectiveness of the various types of conical entrances in reducing the entrance loss.

The tests of a 45-deg. wing wall used in connection with a corrugated metal pipe culvert show that it has a slightly beneficial effect in reducing the entrance loss

below that resulting from the use of the straight end wall. The average entrance loss coefficient for these wings used with corrugated metal pipe culverts is 0.221.

A bell end pipe culvert used with a 45-deg. wing wall actually shows a greater entrance loss and a lesser discharge than the same pipe with the straight end wall. The average entrance loss coefficient for these wings used in connection with the bell pipe is 0.114, whereas for the straight end wall it is 0.063.

U-type wings are relatively inefficient compared with a straight end wall in reducing the entrance loss in bell end pipe. The wings increase the entrance loss and consequently decrease the discharge of the culvert. The average entrance loss coefficient for the U-type wings is 0.197 compared with 0.063 obtained for bell end pipe with the straight end wall.

Apparently for the beveled lip pipe it makes very little difference in the entrance loss whether the pipe projects three inches, two feet, or four feet beyond the head wall. When the 12-in. concrete pipe with a square corner projected 3 in. beyond the head wall, the entrance loss coefficient was 0.354; with a 2-ft. projection the entrance loss coefficient was 0.342; and with a 4-ft. projection, the entrance loss coefficient was 0.361. However, for a 4-ft. projection of 12-in. concrete pipe with beveled lip entrance, the entrance loss coefficient was only 0.092.

For 18-in. corrugated metal pipe with a 3-in. projection the entrance loss coefficient was 0.314, while for the same pipe with a 2-ft. and 4-ft. projections the entrance loss coefficients were about 0.55.

The carrying capacity of bell-end pipe culvert with a straight end wall may be increased somewhat by filling the bell with cement mortar, rounding the mortar so as to form an elliptical entrance.

The discharge of any pipe culvert having a square-cornered entrance may be increased by setting the pipe back a few inches from the face of the head wall and rounding the concrete in the head wall next to the circumference of the pipe.

Discharge a Function of Square Root of Head for Full Culvert

The conclusion that the discharge of a culvert is proportional to the square root of the head and bears no relation to the grade at which the pipe is laid is, of course, based upon the assumption that the culvert is designed to flow full, an assumption which probably departs from the prevalent practice, but it is believed that there are sound reasons for altering present methods of design in this particular.

If highway culverts are so designed and installed that they are only partially filled at times of great run-off, one naturally asks just how deep should a culvert be filled to discharge the water for which it is designed? This depth might form the basis for a "capacity" rating for comparing different types of culverts. On the other hand, if a culvert under such conditions discharges only partially full, is there not great lack of economy in the design which gives a larger waterway than necessary? After considerations such as these the writers concluded that the normal basis for comparing culverts should be established upon the pipe flowing full, giving its maximum capacity with a given "head." It is certain that most pipe culverts, even 18 or 24 in. in diameter, although installed to drain only a small area, may at some time be taxed to their full capacity. For instance, a run-off of 1 in. in 20 min. from 2 acres of land will entirely submerge an 18-in. pipe at the inlet. It seems only logical, therefore, that the full culvert should be the capacity basis for design.

It is recognized that an obstacle to the design of culverts as pipes flowing full is presented in the inclination of engineers to keep the culvert high in order to reduce the quantity of ditching at the outlet end. The writers believe that sometimes this procedure reduces the discharging capacity of the culvert below what might easily be obtained by merely lowering the culvert at slight expense under favorable conditions. They can see no danger in installing a culvert so that it will flow full if possible. The "head" or pressure involved is not as dangerous as it might seem. Flowing under a "head" is intended to mean merely flowing full, not flowing under any excessive head.

The statement that the discharge bears no relation to the grade at which the pipe is laid under the conditions assumed implies no objection on the part of the writers to the laying of culverts on slight grades. Culverts are laid on a slope in order that they may clear themselves of sediment during normal flow, but it is not *necessary* to lay a culvert on a slope to develop maximum capacity, i. e., flowing full; in fact, it is quite doubtful if the practice of laying the culvert on a grade has all the merits claimed for it. Certainly in flat country the culvert grade does not determine the velocity of flow, but rather the difference in elevation of the water at the upstream and downstream ends. Even when flowing partially full, the water surface will find the grade it

Table 3.—Summary of Results of Test Data

Pipe, Kind.	Size, Inches.	Remarks.	Entrance Loss Coefficient.
Concrete	18	Straight end wall entrance—Pipe with beveled lip..	.097
Concrete	24	Straight end wall entrance—Pipe with beveled lip..	.093
Concrete	30	Straight end wall entrance—Pipe with beveled lip..	.137
Concrete	18	Straight end wall entrance—Pipe with square end..	.404
Concrete	24	Straight end wall entrance—Pipe with square end..	.437
Concrete	30	Straight end wall entrance—Pipe with square end..	.493
Clay	18	Straight end wall entrance	.044
Clay	24	Straight end wall entrance	.095
Clay	30	Straight end wall entrance	.120
Metal	18	Straight end wall entrance	.200
Metal	24	Straight end wall entrance	.225
Metal	30	Straight end wall entrance	.295
Concrete	24	Straight end wall entrance—Pipe with beveled lip..	.061
Clay	24	Straight end wall entrance	.122
Clay	24	Straight end wall entrance	.057
Metal	24	Straight end wall entrance	.230
Metal	24	Straight end wall entrance (ascending series)	.212
Metal	24	Straight end wall entrance with floor in front of entrance	.436
Clay	24	Conical entrance, 13 deg. angle, 20 inches long	.027
Metal	24	Conical entrance, 13 deg. angle, 20 inches long	.040
Metal	24	Conical entrance, 24 deg. 47 min. angle, 10 inches long	.050
Clay	12	12-18-inch standard commercial increaser used as entrance	.083
Metal	24	45 deg. wings, full height, set flush with inside edge of pipe, without floor in front of entrance	.168
Metal	24	45 deg. wings, standard height, set flush with inside edge of pipe, without floor	.243
Metal	24	45 deg. wings, full height, set 6 inches from inside edge of pipe, without floor	.224
Clay	24	45 deg. wings, full height, set flush with inside edge of bell, with floor in front of entrance	.116
Clay	24	45 deg. wings cut level to top of standard end wall and set flush with inside edge of bell, with floor in front	.122
Clay	24	45 deg. wings, standard height, set flush with inside edge of bell, with floor in front of entrance	.106
Metal	24	45 deg. wings, standard height, set flush with inside edge of pipe, with floor in front	.365
Clay	24	U-type wings cut on bevel to top of standard end wall and set flush with inside edge of bell, with floor in front of entrance	.177
Clay	24	U-type wings, standard height, set flush with inside edge of bell, with floor in front of entrance	.291
Clay	24	Straight end wall with entrance bell filled with concrete and surfaced off straight from inside edge of bell to inside edge of pipe	.044
Clay	24	Straight end wall with entrance bell filled with concrete elliptically shaped with convex surface out.	.020
Clay	24	Straight end wall with entrance bell filled with concrete shaped to give a square-cornered entrance.	.478
Concrete	12	3-inch projection beyond head wall—Pipe with square cornered entrance	.354
Concrete	12	47-inch projection beyond head wall—Pipe with square-cornered entrance	.361
Concrete	12	47-inch projection beyond head wall—Pipe with beveled lip	.092
Metal	18	3-inch projection beyond head wall	.314
Metal	18	48-inch projection beyond head wall	.568
Clay	18	Straight end wall entrance 18 to 26 inch cone, 60 inches long at outlet end of pipe, length including cone 30 feet	.032

needs for flow through the culvert irrespective of the slope of the bottom of the culvert. The writers have performed experiments which demonstrate that the slope is not very great at which the discharge capacity of a culvert, even with the inlet end submerged, will be considerably less for a given difference in water surface upstream and downstream than for the same culvert built at a flatter grade.

The question has been raised as to whether the significance of the nature of the entrance would be as great in the case of pipes flowing less than full, as in the experiments with pipes flowing full under head. It has been suggested that under the conditions normally obtaining in pipe culvert installations the width of the approach ditch is greater than the diameter of the pipe and that these conditions might result in the formation of eddies, which would vitiate the effect of the rounded pipe entrance. It is possible to settle whatever doubt there may be on this score. Experiments have been made with culverts flowing partially full and it has been demonstrated that the nature of the entrance is fully as significant as when the pipe flows full, it not more so.

Fire Demonstrates Need of Protecting Creosoted Timber

AN interesting illustration of the inflammability of freshly creosoted timber was afforded by a fire in a large quantity held in storage at Eva, Tenn., for use in the trestle approach to the Nashville, Chattanooga & St. Louis bridge over the Tennessee river. This timber, piled near the track, was set on fire, presumably by hot clinkers thrown from the gangway of a passing locomotive. A high wind fanned the flames and produced such a hot fire that it was impossible to approach the burning piles but the prompt action by a steam shovel engineer in delivering several loads of dirt which were thrown over the remaining piles of lumber, stopped the spread of the flames and saved a large portion of the material.

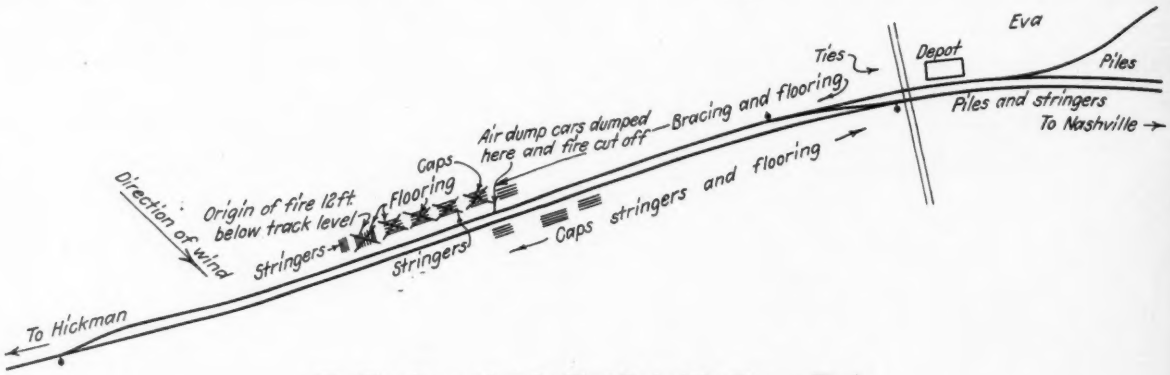
Five carloads of creosoted lumber were burned, which included 98 caps, 66 stringers and 900 pieces of flooring plank, having an estimated value of about $6,000. The following abstract of the report of an investigation made following the fire throws some light on the cause and the precautions which must be carried out to protect such lumber from fire hazard.

In order to minimize the fire hazard the timber had been stored over as wide a territory as possible. As shown in the sketch, the material piles extended along both sides of the main track for a distance of about 1,400 ft. Barrels full of water were placed at numerous points throughout the stored timber and two watchmen were maintained in 12-hr. shifts with instructions to patrol the yard at all times and especially to go over the entire yard after the passage of every train. Because of the large amount of timber involved no attempt was made to cover the piles with earth and some of the timber was not closely piled.

Just previous to the fire, a westbound train pulled into Eva and stopped on the main track with the head end at the west switch. The engine was then cut off and backed down the passing track to pick up a car on the house track. Just at this time the watchman and the section foremen, who were standing on the road crossing immediately west of the depot, observed smoke arising from the lumber piles at the west end of the yard. By the time the engine could pull out through the passing track with the car which had been picked up, couple onto the train and depart, the fire had become so hot that one of the cars in the train was almost ablaze and the paint on several cars was blistered.

The direction of the wind precludes the possibility of the fire having been started from sparks from the stack of the locomotive but two clinkers about eight inches in diameter were found lying on top of the wood ashes at the point where the fire started. This point is about 12 ft. below the track level and at about the point where clinkers thrown from the gangway of an engine on the passing track would land. The fireman was cleaning and overhauling his fire at Eva and admits having pulled out two clinkers while the engine was on the passing track at the depot and having pushed them off of the gangway of the engine between the passing track and the main track. Clinkers were found lying in this position the day after the fire.

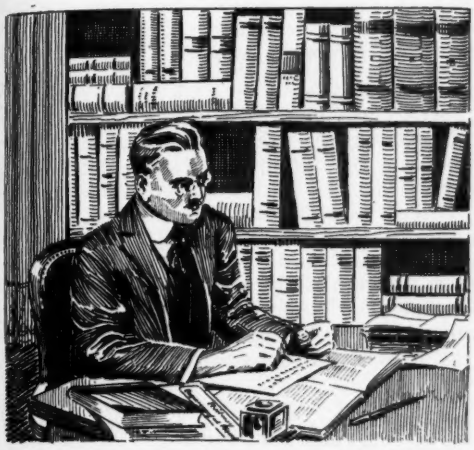
The conclusion was reached, based on the circumstantial evidence, that the fire was caused by the throwing of red hot clinkers into one of the piles of lumber. The fire was restricted to certain piles of the lumber by covering those in which the fire had not started with earth delivered in dump cars, demonstrating the need of protecting creosoted timbers properly by covering them with earth and also insuring that the timbers are closely piled.



The Fire Occurred at the West End of the Storage Yard

LONG RAIL FOR SOUTHERN PACIFIC—The Southern Pacific has ordered 131,245 tons of rails, 82,231 tons of which is of 110 lb. section, and all of which is to be rolled in lengths of 39 ft. This constitutes the largest order yet made by railroads for 39 ft. rail and is one of the few orders placed by any road west of the Mississippi for rail heavier than 100 lb.

What's the Answer?



This department is intended to help our readers secure answers to the questions which arise in their work in the maintenance of tracks, bridges, buildings and water service. An endeavor will be made to answer promptly by mail, any questions received. Such questions as are of general interest will also be submitted in these columns for further discussion. *Railway Engineering and Maintenance* solicits the co-operation of its readers in answering the questions which are published.

Questions to be Answered in the July Issue

1. What should be done with cross ties which are found to be in sound condition after they were removed?

2. Where traffic on a creosoted timber highway overcrossing results in an amount of wear to the floor planks warranting the use of untreated planks, should these be made heavy enough to dispense with treated subplanking?

3. What are the reasons prompting the use of longer rails? What are the limitations?

4. Under what conditions can air be used advantageously in restoring the flow of a well and how should this be done?

5. Are permanent track center stakes or monuments desirable? If so, at what intervals should they be placed?

6. How soon after a rain is it safe to paint a frame building?

7. What are the advantages, if any, of giving a certain portion of the track of each section a thorough overhauling each year?

8. What precautions are necessary to secure good results in repointing old stone masonry piers and abutments?

Locating Obstructions in Water Lines

What is the best method of locating and determining the extent of obstructions in water supply lines?

Obstructions in water supply lines are of two general classes: (1) local obstructions, usually foreign bodies or dropped gates of valves, etc., and (2) continuous obstructions throughout the entire length of a line, which are due usually to tuberculation or deposits from water treating plants, etc.

The presence of obstructions, whether local or continuous, will usually be indicated by a decrease in the quantity of water carried by the pipe line or by a change of pressures in the pipe line, or by both. If the line is a gravity main, the pressure or quantity or both will decrease at the delivery end. If it is a pumping main, the pressure will also decrease at the delivery end, provided the pumping pressure is maintained the same, but it will be necessary to raise the pumping pressure in order to obtain the usual delivery.

If the presence of an obstruction is suspected, the carrying capacity of the line should be determined and compared with that of a new line operating under similar conditions. The existence of continuous obstructions, such as coatings on the inside of a pipe line, will generally be known or suspected by reason of the character of the water, the nature of the water treatment, if any, and inspections made at the time of repairs or by tapping the line. Such deposits can only be removed by pipe cleaning.

If the obstruction is local, the loss in pressure through the pipe line will not be uniform, but will be concentrated at the obstruction. The flow through the line should be increased as much as possible above the normal operating conditions in order to increase the loss of pressure, which will make it easier to determine the location of the obstruction. Valves should be tested first, in order to be certain that the trouble has not been caused by a broken stem or lug, permitting the gates to drop. Sharp bends in the line should next be investigated, as large foreign articles naturally tend to collect at such points. If a profile of the pipe line is available, the hydraulic grade line is a simple and practical method of locating local obstructions. Determine the pressure at a number of points on the line, plot these on the profile and draw a line through the points. This line is the hydraulic grade line for the delivery in question, and simply represents the height to which the water would rise in the pipe line at any given point for the conditions of flow at the time the observations were made. For constant size of pipe line and uniform delivery, this hydraulic grade line will be a straight line, but an obstruction will cause a sharp break in the line. The section having the greatest loss of head, which will be the section having the sharpest grade line, should be sub-divided until the obstruction is located, so that a cut can be made at the proper point.

Very large local obstructions can sometimes be located by listening on the pipe with an aquaphone or some similar device, as the water rushing past a large obstruction is quite turbulent and causes a noise which is noticeable when using any listening device.

If the pipe line is comparatively short, obstructions

can sometimes be located by floating through the line a bag of sawdust or some similar material attached to a rope or cable. When the obstruction is reached, the bag will stop and the length to the obstruction can be definitely measured.

Methods of locating obstructions, which depend on measuring the flow or velocity, assume that there is no leakage from the pipe line. Material leakage will influence all such methods.

CHARLES HAYDOCK,
Engineer, Pennsylvania Water Companies, Philadelphia.

Anchoring Crib Walls

What is the best way of anchoring a crib wall in an embankment?

The secret of the successful anchoring of a crib wall in an embankment lies in the thorough tamping of the filling material as each additional layer, or line of stretchers and headers is placed. The common, so-called, failure of crib walls is due to the fact that engineers neglect to put in a line of stretchers back of the face wall, thereby depending solely on the headers extending back into the fill providing sufficient anchorage. This is done with a view of the construction of relatively low walls; but, due to later construction requirements, the walls are subsequently raised, and at times a considerable surcharge added, and, with the insufficient anchorage of the headers, the wall gives way.

Experience shows that the safe way of constructing crib walls is to use the front and rear stretcher type of construction, whether made of timber or concrete, due to the fact that the wall can be later raised in height as desired, without fear of failure. I would suggest that, in cases where relatively high walls are required and where it is impracticable to tamp the filling material as each layer is laid, the additional anchorage can be obtained economically by tying the wall, temporarily, to anchor stakes placed in the rear. These ties can be made with two strands of No. 8, or heavier, soft wire, attached to the anchor stakes in the rear, and to wooden slats on the face of the crib wall, to serve until such time as the filling is compacted. These precautions, however, are not necessary with relatively low walls, unless there is a considerable surcharge.

C. P. RICHARDSON,
Engineer Track Elevation, Chicago, Rock Island & Pacific, Chicago.

Resurfacing After Rail Laying

Should track be resurfaced when rail is laid and, if so, how closely should this follow the rail laying?

First Answer

Rail removed from main track in replacement operations is usually surface bent, especially at the joints. Because of this condition the tops of the ties are seldom in good surface. Therefore, if the new rail is laid on the ties in this condition and allowed to remain any length of time it is certain to be damaged permanently. Shims used to counteract this condition are but a temporary remedy and at best are unsatisfactory, shortening the tie life by reason of the added pulling and driving of spikes required by their installation. Track on high shims of the kind usually placed by steel gangs is not safe at high speed.

The best way to prolong the life of rail is to keep the rail in good surface on a good foundation. For this reason, it is advisable to surface track as quickly as the rail is relaid, the surfacing gang being not more than a day behind the rail gang. Too often steel is laid and allowed to remain through a winter without surfacing because the steel gang gets ahead of the surfacing gang. This is bad practice.

K. L. MORIARITY,
Assistant Engineer Maintenance of Way, Chicago Great Western, Chicago.

Second Answer

It is good practice to resurface track where rail is replaced in order to give all ties a uniform bearing. This is especially important where the practice is adhered to of respacing the joint ties for the purpose of slot spiking. Where this respacing of joint ties can be avoided by the use of rail anchors placed so as to relieve the joint ties from all strain and permit the joints to "hit or miss," a great saving can be obtained by not having to resurface the track every time it is relaid, as well as in not having to respace the joint ties. Aside from the reduced expense of laying rail a further advantage comes from not having disturbed the foundation of the track.

J. J. HESS,
General Roadmaster, Great Northern, Seattle, Wash.

Third Answer

It is not always necessary to resurface the track immediately after rail is relaid, providing the rail removed has been maintained in first-class condition, but if the track was rough before the rail was changed, resurfacing ing and spacing should follow the rail laying at once in order to protect the new rail. Best results are obtained by giving the track a light lift after the new rail is laid, which will facilitate the renewal and spacing of ties. In this way, a better surface is secured. By giving a new bed to all of the ties the settlement will be uniform. The result of this will be prolonged life of the rail and a reduced cost of repairing the rolling stock.

J. W. POWERS,
Supervisor, New York Central, Rochester, N. Y.

Editor's Notes

W. T. Collins, yard foreman on the Union Pacific, Junction City, Kan., also maintains that the necessity for resurfacing track after relaying depends upon the condition of the track and the ballast at the time, going so far as to state that where a sufficient number of anti-creepers have been used the section gang can usually look after any irregularities in the surface, thus dispensing with the surfacing gang. When the ballast is in poor condition and the surface irregular, however, his view corresponds with that already expressed that the surfacing gang should follow closely after the steel gang. It is his view, moreover, that when the ballast is foul and a heavy lift is required, the surfacing gang should be followed by an additional, though small, gang to look after the line and surface and general dressing up of the track.

Writing from Timblin, Pa., on the Pittsburg & Shawmut, Nick Batina, foreman, agrees that some surfacing should be done at once, but contends that the surfacing should be confined to the bad spots only, leaving the general surfacing to be done eight or 10 days later, when the track has become solid again. If the rail is laid in the winter, he maintains that the general surfacing should be done just as soon as the frost leaves the ground. It is the contention of Edward Olson, foreman on the Great Northern, at Alexandria, N. D., that where the track is to be raised over four inches the raise should be made before the new rail is laid rather than afterwards.

R. Rossi, general foreman on the Markham yard construction, of the Illinois Central, South Harvey, Ill., is of the opinion that the surfacing gang should keep within a

mile of the rail laying gang, but not so close as to interfere with the flagmen. He has the following to say about organizing the work to permit this being done. "When I was in charge of relaying I had 90 to 100 men under my jurisdiction. Fifty of these men formed the rail laying gang and 14 to 16 men the gang for renewing and spacing ties, two men were engaged on each side of the track to drive the spikes home, and two men equipped with long wrenches were employed on each side of the track to tighten bolts, which left 26 to 30 men to do the surfacing lining and finishing work. When the rail laying was finished, the rail gang turned back and assisted in the completion of the surfacing work. This arrangement proved very satisfactory."

Dumping Ashes on Track

What measures, if any, are practicable to put into effect to prevent the promiscuous dumping of locomotive cinders along the track, thus fouling the ballast?

First Answer

The mechanical department is directly responsible for the condition of ash pans on locomotives, and if the doors on cinder cars are reported by section foremen along the line as being out of order or open, this department should check up on the crew operating that particular train and determine the cause. If defective, it is taken care of at once or before that particular engine leaves the house.

On the Union Pacific instructions are issued to the engine crews that when they find it necessary to dump pans, to stop (on a side track if possible), dump the pans and put out all fire before leaving to prevent the wind blowing live coals into the right-of-way and burning neighboring fields. Close co-operation between the heads of the track and mechanical departments is necessary to arrive at a satisfactory solution of this problem. We are not bothered with this kind of trouble at present, due, I believe, to the plan outlined above.

W. T. COLLINS,
Yard Foreman, Union Pacific, Junction City, Kan.

Second Answer

The action of cinders on ballast and drainage has proved very injurious on this section of the Great Northern, which is in the mountains. The action of the water from the rain and snow on these cinders was to wash all the fine dirt and the refuse to the end of the ties and leave a formation from 1 in. to 3 in. in thickness, which so interfered with the drainage, as to make it necessary to tear down the low side of curves in order to let the water out and eliminate the soft track. As all coal burners have ash pans which can be closed up, there is no reason why the ashes cannot be dumped in piles where the engine stops instead of scattering them along the track. Some firemen have complained about this choking the draft, but during the "fire" season the enginemen are compelled to keep them closed and have been found to be able to make their schedule just the same. Since the advent of the oil burner, no further trouble of this character has occurred in this vicinity.

M. J. KELLEHER,
Foreman, Great Northern, Columbia Falls, Mont.

Third Answer

The dumping of ashes promiscuously is dangerous and expensive. Ties are burned, in some cases, and track may be made unsafe, also, the ballast is fouled on account of such practice. In addition to cinder pits at engine terminals, it is necessary, in some cases, to designate certain places along the road between engine terminals for the dumping of ashes. These places should be located, preferably near water stations, so that the engines can reach them when it is necessary to dump ashes between terminals. This will avoid the dumping of ashes at various places along the road, either on main track or on sidings.

Instructions should be issued and signs placed to show that ashes are to be dumped at such places. To protect the ties, a covering of sheet iron should be placed over them and, when possible, a water line should be provided so that the cinders can be wet down to avoid damage to the ties. In some cases, it will be necessary for engines to dump ashes at points other than cinder pits at engine terminals or the designated points. The excuse that is usually given is that unless the ashes are dumped at such places, extensive damage will be done to the engine. In such cases, the section foreman should make a prompt report to the supervisor, giving the number of the engine, the time, and where the ashes were dumped. The matter can then be reported to the superintendent, and a prompt investigation made by the traveling engineer or fireman to determine if it was necessary to dump ashes at other than regularly designated places.

R. V. REAMER,
Engineer Maintenance of Way, Central of New Jersey, Jersey City, N. J.

The Quality of Water Used in Mixing Concrete

Is the quality of water used in making concrete of importance and, if so, what impurities should be guarded against?

It is well recognized that water containing appreciable quantities of certain impurities is liable to have an injurious effect on the concrete but unfortunately investigations along this line have not proceeded far enough to have resulted in the drafting of definite rules for the guidance of those who make concrete. Specifications, therefore, are rather indefinite as to this question. For example, the specifications for concrete masonry of the American Railway Engineering Association read as follows:

"The water shall be free from oil, acid and injurious amounts of vegetable alkalies or other salts."

The tentative specifications of the Joint Committee on Concrete and Reinforced Concrete contain a clause that is almost a duplicate of this and the same holds true of most other specifications. Text books on concrete construction contain little for the guidance of the man who is confronted with suspicious waters but the following from Hool & Johnson's "Concrete Engineers Handbook" may be found of some assistance.

"Vegetable matter can sometimes be detected by observing floating particles, or by turbidity. Chemical determinations are better and more certain. Tests of water for acidity or alkalinity may be made by means of litmus paper, procured at any chemist's. If blue litmus remains blue on immersing in the water, then the property is either neutral or alkaline; if the color changes to red, then the property is acidic. If there is a dangerous amount of acid present, the change in color will be very rapid. Likewise, if red litmus changes very quickly to blue, the water will be found to contain a dangerous amount of strong alkali."

Concrete structures exposed to waters containing heavy solutions of alkali salts have sometimes suffered serious disintegration but, as explained above, it has been impossible to formulate any definite rules by which it is possible to determine conclusively whether or not the particular water is objectionable. There is, however, one

practical rule which has been found reasonably safe; namely, that if a water is fit to drink it is suitable for concrete work. This, of course, has no reference to the suitability of water for drinking from the standpoint of its polution with sewage since the presence of bacteria which would be dangerous to health has no bearing on the fitness of the water for use in concrete.

Keeping Camp Cars Clean

What supervision should be exercised to insure that camp cars for floating gangs are maintained in proper condition?

First Answer

As a means of maintaining camp cars for floating gangs in proper condition instructions should be issued outlining what is expected in regard to proper maintenance and these instructions should be followed up by surprise inspections made by a committee composed of at least two or three persons, preferably the division engineer, the supervisor of the department and some other person appointed for that particular work. I think the system fire inspector should be invested with authority to pass on the proper maintenance of camp outfits for the reason that it is already his duty to make an inspection of such cars with reference to the condition of all heating units. One important advantage of having a committee handle this matter is that it relieves the individual from the possibility of being criticized unduly in cases where it is found necessary to take action having a tendency to cause ill will on the part of some members of the gang.

C. W. MYERS,
Carpenter Foreman, Yazoo & Mississippi, Memphis, Tenn.

Second Answer

The supervision needed to keep camp cars in proper condition requires (1) that cars should be well built, calcimined or painted on the inside and properly ventilated. (2), that the cars should be scrubbed at least once a week. (3), that a caretaker should be selected who will take an interest in keeping the cars clean. (4), that whenever the cars are scrubbed the beds should be taken outside, spread in the open air and sprinkled with a proper fumigant. (5), that no sick man should be allowed in a camp car with other men. (6), that all of the men should have a medical examination. (7), that toilets should be built not less than 100 ft. from the outfit cars or labor camp, and (8), that no drunkard or trouble maker should be allowed around the camp, as these men are usually the ones who mess up the cars and who are responsible for the unclean or disagreeable conditions in the cars. R. ROSSI,
General Yard Foreman, North Markham Yard, Illinois Central.

Third Answer

To keep camp cars in proper condition each gang should be equipped with separate sleeping and toilet rooms. The practice of having the toilet facilities and the sleeping bunks in the same room creates a very unsatisfactory condition, being unhealthy and creating dissatisfaction among the men. Where the toilet and bunks are in the same car, moreover, there is no accommodation for reading and writing while if they are separate each car could be fitted up to better advantage.

J. AZZUOLO,
Yard Foreman, Canadian National, Foleyet, Ont., Canada.

Fourth Answer

To insure that camp cars for floating gangs are maintained in proper condition the stoves should be inspected each month by the roadmaster and he also should make an inspection at that time with reference to other fire hazards and particularly with reference to the cleanliness of the camp. The foreman should be impressed with the importance of keeping the camp cars clean and in this connection should be required to make a weekly inspection of all cars. G. E. STEWART,
Assistant Engineer, Southern Pacific, Stockton, Cal.

The Cheapest Way to Renew Ties

Can tie renewals be made most economically by the regular section gang or by extra gang?

The several answers received to this question are unanimous that under ordinary conditions it is more economical to renew ties with the section gangs. J. J. Hess, general roadmaster, Great Northern, Seattle, Wash., gives as his reasons for this opinion that "the section gangs are smaller than extra gangs, which gives the foreman a better opportunity to supervise the work efficiently. A section foreman will take greater pains to see that the work is done properly since he appreciates the many advantages to be obtained from careful work and, because it is more to his interest than to the interest of the extra gang foreman that the work is done well." On this point, W. T. Collins, yard foreman, Union Pacific, Junction City, Kan., goes as far as to say that, "In all my years of railway work I have yet to find an extra gang foreman who will take the necessary interest in renewing ties to have the work done more economically than the section forces, the reason being that the responsibility of the extra gang foreman ends with his departure from the locality and it is his tendency to rush the work through, which makes it necessary for the regular gang to follow him up."

George Poulos, foreman on the Great Northern, at Mitchell, Mont., gives as his reasons for the superiority of section gang work over extra gang ties, (1) "that the section men are employed steadily on that section; (2) that they have a wider experience in general track work, and (3) they know how many ties can be removed and replaced by each man to accomplish a full day's work with the result that each man tries to do his part." He describes extra gangs, on the other hand, as composed largely of "drifters, of which about two-thirds are untrained in tie renewal work, with the result that the work is done in too much of a hurry, which usually throws the track out of line and surface at the same time."

Edward Olson, a Great Northern foreman, at Alexandria, Minn., and Nick Batina, foreman on the Pittsburgh & Shawmut, at Timblin, Pa., also mention the unnecessary disturbance to the track that results from using extra gangs to make tie renewals, Nick Batina's method of avoiding this being to place two men on each tie and lift the rails a half inch by inserting a spike between the rail and the tie plate on the tie nearest to the one being removed. This lifts the rails enough to allow the removal of the old tie without disturbing the ballast, or leaving the ties hanging, as he claims is usual with extra gangs.

Where the track is in such condition as to require from eight to 10 tie renewals per rail, however, Nick Batina is of the opinion that more and better work can be performed by extra gangs or enlarged section gangs, which gangs are required when a lift up of two or three inches is to be made at the same time. Joseph Azzuolo, foreman on the Canadian National, at Foleyet, Ont., also defends the tie renewal work by extra gangs with the statement that "in the northern latitude the spring of the year comes so quickly as to leave most of the section work, such as drainage, bolt tightening, gage adjusting, removing shims, etc., to be done at the same time as the

tie renewals." Since there are usually not enough men to be obtained locally by the section foreman and since extra gang forces can usually be obtained for less wages it is usual to organize such gangs for the purpose.

The difference in climate between this section and the western United States suggests the reason for the difference in this viewpoint of Joseph Azzuolo from Canada, and that of G. E. Stewart, assistant engineer on the Southern Pacific, at Stockton, Cal., who claims that tie renewals should be made throughout the year on each section ,taking out the individual ties as they require renewal rather than waiting until extra gangs are required to make out-of-face renewals.

As to the method of making tie renewals where the work is done by section gangs, R. Rossi, general foreman of construction of the Markham yard of the Illinois Central, at Harvey, Ill., has the following to say: "In order to renew ties to the best advantage, each regular section gang should renew the ties on its section and not be required to work on other sections. If one section has more ties to renew than another, this section should be allowed more labor. When the regular section gangs are shifting around to assist other sections in making renewals, disorganization results and money is wasted. The observations which I made where the practise was to consolidate gangs for tie renewal work are that the two gangs do not renew any more ties than are renewed by one gang on its home section." George Poulos on the Great Northern also contends that where section gangs are enlarged in the spring the new men should be kept separate from the regular men, since the foreman can depend upon his regular men to work without his being present all the time, and thereby can devote most of his time to training and watching the new men. "Putting old men and new men together," he says, "often causes trouble in the gang, because if you put one trained laborer with one untrained laborer the trained man has to show the untrained man how to work, but most of the new men think that only the foreman should supervise their work. The result is that the new men lose their temper, which results in quarreling in the gang."

The method of making tie renewals, favored by W. T. Collins, is that of enlarged section gangs, in connection with which he has the following to say: "My plan has been to obtain, if possible, enough extra men to do this kind of work as early in the spring as the delivery of material and weather conditions will permit in order that this heavy work will be completed before the hot weather, when labor efficiency is decreased. Where an extra gang will apply ties for 20 cents in the early spring under favorable conditions, it will cost 25 cents in the summer months. Moreover, the extra gang can only tie up each section as it proceeds along the railroad, while with the regular section gangs the tie renewal work is going on at the same time on all sections."

Copper Salts Fail to Stop Marine Borers

IN EFFORTS to ascertain the best possible means of protecting piles and other timber immersed in sea water from the attacks of marine borers, experiments were made recently to determine the effect of impregnation with copper salts. These tests were made on southern pine, in the harbor waters at Pensacola, Fla., by the United States Forest Products Laboratory, the idea being suggested by the observation that marine borers have, in some cases, failed to attack wood in the vicinity of copper nails or sheathing.

The treating solution used for the particular group of specimens shown was composed of 8.5 parts sodium carbonate, 1.5 parts sodium bicarbonate and 100 parts water mixed with a heavy solution of copper sulphate. The alkaline carbonate solution is supposed to dissolve about 0.7 per cent copper sulphate. A pressure treatment was used to insure thorough impregnation.

The scientist who suggested a trial of this solution by the laboratory believed that in the course of several

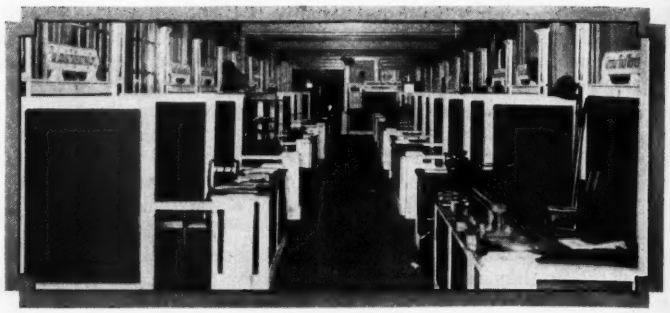
Appearance of the Copper Treated Specimens After Fourteen Months in Sea Water

hours after treatment a double salt of copper and sodium, completely insoluble in water and, therefore, not liable to wash or leach out, would be crystallized out in the wood. Although a material completely insoluble in water would not be toxic, it was thought that the body acids of the borers would liberate sufficient copper to make it effective. In a 14-months test, however, the treated specimens were attacked by shipworms and reduced to a spongy, friable condition.

No conclusion applicable to all copper salts should be drawn from this test. A treatment which will protect submerged wood by marine organisms is still being sought by the National Research Council and the Forest Products Laboratory. Up to the present time, however, coal tar creosote is the preservative which has given most effective service in retarding shipworm destruction.

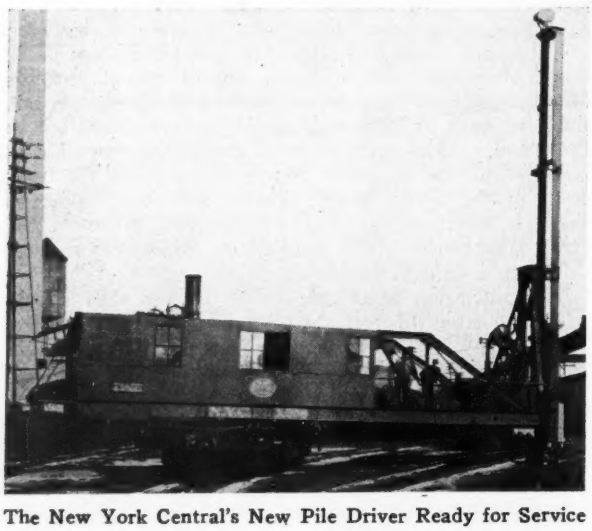
Reinforced Concrete Sheet Piles Stored for Use Under the Stuyvesant Docks of the Illinois Central at New Orleans, La.

New and Improved Devices



McMyler Builds 115 Ton Pile Driver

A PILEDRIVER has recently been built for use on the New York Central which involves a number of new departures in design. The machine is of full circle swing construction, which permits direct leads for all operating cables, the advantage of which is in avoiding numerous reversing bends with their attendant additional wear and strain on the cable. Another advantage of this full swing construction is in the equalized weight distribution obtained. The pile driver is large, weighing 115 tons, but the weight is equally distributed on both trucks when the leaders are lowered in position for transportation from one place to another by train. With the leaders



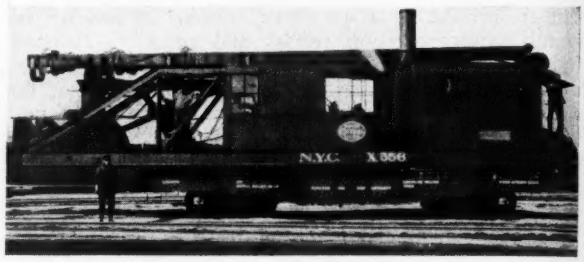
The New York Central's New Pile Driver Ready for Service

raised in the driving position at right angles to the track, the weight is also distributed evenly on the four wheels on the driving side.

The pile driver has a reach of 33 ft. 9 in. from the track, which reach has been provided particularly for use in maintenance work where it is desired to span adjacent tracks, as in the driving of far side abutment piles. Likewise it permits the driving of piles from either end without having to switch or turn the driver around or allows its being coupled into a train from either end.

A separate set of drums is installed to raise and lower the large pile driving leaders, which is done quickly. Once raised they are automatically locked in position for driving and by means of a rack and thrust pin they can be turned and fixed at any angle within 15 deg. of the vertical for driving batter piles. The load in the leaders is 17,000 lb. The hammer is a No. 2 Vulcan-Warrington steam hammer fitted with a McDermid base.

A feature of the propelling mechanism is the gear shift arrangement, which is similar to the gear shift on an automobile and gives two speeds to the driver, a slow speed of 7½ miles an hour or a fast speed of 17½ miles per hour. Intermediate speeds are controlled by the main throttle. The tractive effort developed by the machine is sufficient to enable the driver to haul a tender and four or five work cars. The driving mechanism is



The Leaders Lowered for Transportation

enclosed in a steel cab with clearances such that with the leaders resting on the top of the cab there is no difficulty in passing through tunnels or bridges.

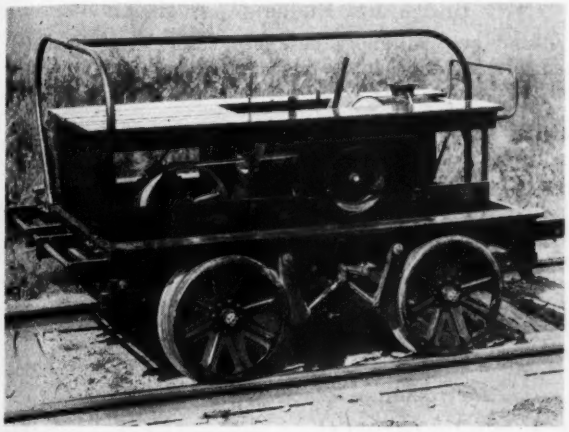
The machine is made by the McMyler-Interstate Company, Cleveland, Ohio, and is the second machine of the full circle type built by this company for the New York Central.

A Two Speed Motor Car for Heavy Duty Service

THE CONDITIONS prevailing on many railroads which make it desirable to employ motor cars designed for either normal or heavy duty to meet varying loads and grades have resulted in the development of a new motor car, the salient features of which are (1) its ability to accommodate 12 men and tools on its own deck with sufficient additional power to haul as many as 60 men on trailers on grades up to 1.5 per cent and as many as 35 men on 4.0 per cent grades, and (2) a transmission which provides for two speeds in either direction. While this car has been designed particularly with a view to its use interchangeably by extra gangs and section gangs, the claim is made that it is not only ecnomical in extra gang service but that by reason of its low initial cost it is quite as economical as the ordinary car in section gang service. The requirements of work involving the pulling of mowing machines, discs, etc., are all said to be met in the design.

The Oil Tight Transmission Case

The car, which is a product of the Fairmont Railway Motors, Inc., Fairmont, Minn., is called the MT2 motor car. It has many features in common with other Fairmont cars. The power is furnished by a six h. p. ballbearing Fairmont engine, which has a 50 per cent overload capacity and operates on the free-running principle. The two speed transmission is a Fairmont creation. With the reversible engine, it provides two speeds in either direction. The power of the engine is transmitted by belt to the two speed gear, and from the transmission to the drive axle by means of a roller type chain. The transmission proper consists of an oil tight case enclosing cut gears mounted on ballbearing shafts, an arrangement which offers low frictional resistance and protects the mechanism from faulty lubrication or dirt. An important feature of the transmission is its location at the drive wheel end of the car rather than at the engine end, an arrangement



The New Fairmont Heavy Duty Car

which avoids excessive strain on the drive belt when the car is running in low gear. Again, the belt is located above the line of snow or wet weeds, which prevents slipping from this cause when the car is heavily loaded.

As in other Fairmont engines, the speed of the car is controlled by means of the throttle lever which governs the amount of fuel charge admitted to the engine, while the stopping and starting of the car is accomplished by means of the brake and the levers which slide the engine back and forth on the sliding base. These controls are centrally located so as to permit quick action in case of emergency.

The new car is regularly supplied with battery ignition but when desired may be equipped with a magneto. Lubrication is provided by mixing oil of the right grade with the gasoline, the advantage of this, aside from insuring the uniform distribution of oil, being a proportional increase in the amount of oil as more gasoline is consumed to meet the demands of heavier work.

The frame is of oak with two long diagonal braces and two auxiliary braces to keep it rigid. This frame accommodates a pipe railing running entirely across the car at each end for lifting the car on or off the tracks and may be equipped with footboards which extend out over the wheels. The housing extends the full length of the car. This housing and the frame form two tool trays extending the full length of the car, each 4-in. deep, 11¾ in. wide and 76 in. long. The car is equipped with a safety railing and a front guard. The wheels are 20 in. in diameter, mounted on 1½ in. axles which run in Hyatt roller bearings. Side thrust is taken care of by adjustable truss collars. The car weighs 1,050 lb. complete ready to run.

Improved Equipment for Killing Weeds

CHEMICAL methods of weed killing have been in use now for a considerable period and have proved to be an effective agency for this purpose with a consequent reduction in labor requirements and costs. As a result of the more intense use of these methods, many types of equipment have been developed to secure greater efficiency. One of the recent developments along this line is an improved portable type of spray machine which has been built by the Chipman Chemical Engineering Company, New York, for use particularly on comparatively light growths of weeds or on retreatment work. This unit supplements the heavier type of equipment, which this company employs for applying weed killing chemicals where there is extensive and difficult work to be done or where a heavy growth of weeds is to be encountered.

The portable equipment utilizes the spray method of application and consists of three units, i. e., a small gasoline motor-driven centrifugal pump, a double strainer and meter, and the spray nozzles, valves and their connecting pipes. These units are of such size and weight that they can be packed in three portable shipping crates for handling by express between points of treatment. It requires about three hours to set them up or to knock them down. The total weight for shipment is about 700 lb.

One of the interesting features of the equipment is the pump unit by means of which it is possible to deliver a maximum quantity of chemical to the nozzles at a constant pressure of from 12 lb. to 15 lb. per sq. in., re-

An Assembly View of the Equipment

gardless of the quantity of material in the tank cars. This constant pressure delivery plus the metering of the chemical allows the operator to have an accurate control of the rate of application. The pump unit and the meter are also used in the charging of the tank cars, the output being such that all of the chemical needed in the one-to-four mixture which is used is pumped into the cars in less time than it takes to secure the necessary water from the roadside tanks.

The output from the pump and the meter is passed through a strainer to prevent possible clogging of the nozzles, a duplicate or double unit being installed with the necessary valves to permit the alternate use of the strainers as one becomes clogged. The main delivery pipe is 2½ in. in diameter and feeds five leads to the nozzles, each 1½ in. in diameter. Each lead is controlled independently by a valve operated by a hand lever. The usual installation includes nine nozzles, the average width

of treatment being about 14 ft. The arrangement of the nozzles in respect to the five leads is in a 1-2-3-2-1 order. The design and arrangement of the equipment is such that it may be installed on any ordinary type of flat car and is complete within itself except for the pipe connections to the tank cars.

Life of Fences Increased by New Galvanizing Process

GALVANIZING has been employed for so long as a means of protecting steel and iron from rusting that there is no question concerning its value. The principal problems in the production of galvanized products are to secure uniformity of distribution of the zinc where heavy coatings are desired and to so fabricate the wire as not to destroy the bond between the zinc and the metal. Both of these problems have been especially difficult of solution in connection with the manufacture of wire, for the contact of the zinc with wire upon which the coating has been placed may be endangered if the wire is subjected to more than the ordinary distortion. It is impossible to manufacture woven wire

A Fence of the New Process Wire Enclosing a Railroad Shop

fencing, however, without introducing sharp bends in the wire which tend to cause the coating to scale or chip off. It has, therefore, been the common practice in weaving such wire into fencing, to apply coatings thin enough to stand the strain of machine fabrication without actually cracking off, to accomplish which it has been found necessary to keep the deposits down to about 25 to 30 lb. per ton of product.

The obvious disadvantages of galvanizing wire before weaving it into fence have led some manufacturers to attempt to galvanize it after weaving. While this has its advantages, much difficulty has been encountered in "wiping" the wire effectively when woven, by reason of the tendency of the zinc to form lumps at the intersections. It is claimed, however, that this difficulty has been overcome by the development of a process by the Cyclone Fence Company, Waukegan, Ill., whereby a uniformly distributed and intimate coating of zinc may now be applied to the wire to the amount of 135 lb. of zinc to the ton of product, or almost five times as much as it was possible to apply by the methods commonly used. Tests made in the laboratories of the Robert W. Hunt Company are said to have shown the ability of this wire to stand eight one-minute dips in a copper sulphate solution before any evidence of a copper deposit was apparent on the wire, as distinguished from standard telegraph wire, which is required to withstand only four one-minute dips.

With the Associations

Bridge and Building Association

The Hotel Baltimore has been selected as the headquarters for the next annual convention, which will be held at Kansas City, Mo., on October 21-23.

American Wood Preservers' Association

Although the committees were appointed only a month ago they are actively engaged in their work and two of the committees—the treatment of car lumber and tie service records—have held meetings. E. J. Stocking, president, wired Senator Smith, chairman of the Committee on Interstate Commerce, on April 15, expressing the opposition of the association to any change in the Transportation Act and urging the committee to leave it in its present form.

Metropolitan Track Supervisors' Club

The regular meeting of the Metropolitan Track Supervisors' Club was held at the Hotel Martinique, New York, on April 12. The subject before the meeting was The Most Economical and Efficient Method of Protecting Railroad Grade Crossings. C. A. Disbrow, of the Rail Joint Company, New York, presented a motion picture on the development of railway track, the action of rail joints under passing trains and the lining of track with track liners.

International Track Supervisors' Club

The International Track Supervisors' Club held a postponed meeting at the Hotel Broezel, Buffalo, N. Y., on April 3, at which the subject of The Housing of Extra Gang Laborers was discussed. The discussion was introduced by a short paper on this subject, presented by J. W. Powers, supervisor of track, New York Central, Rochester, N. Y.

Maintenance of Way Club of Chicago

The relations of signal men to the employees of the maintenance of way department was the subject of a paper presented before the Maintenance of Way Club of Chicago on April 16, by J. A. Peabody, signal engineer of the Chicago & North Western.

Roadmasters' Association

The work of the association is making good progress. The preparation of committee reports is well in hand, while more applications for membership have been received since the last convention than in the same period of any recent year.

Arrangements have been made for the members from western points to travel to the convention, which will be held in New York, September 16-18, on a special train on the New York Central which will leave Chicago on

Sunday afternoon, September 14, and arrive in New York early the following evening, sleepers from St. Louis and Cincinnati connecting with the train en route. Arrangements have been made with the Hotel Commodore, in which the convention will be held, for a representative to board the train before its arrival in New York to register and assign rooms, thus avoiding delay at the desk on arrival.

American Railway Engineering Association

The board of direction has selected the personnel of committees and the subjects for their consideration for the ensuing year. The appointments include three new chairmen of committees: G. L. Moore, Committee on Rail; T. E. Rust, Committee on Signs, Fences and Crossings, and J. R. W. Ambrose, Committee on Yards and Terminals.

An outline of the subjects assigned to the committees, together with the names of their chairmen. follow:

Roadway—Corrugated metal culverts for railroad purposes, preparing specifications with assistance of Committee on Iron and Steel Structures; grading contract, working with Committee on Uniform Contract Forms; report on any unusual methods of handling roadway problems in connection with slips, slides and water pockets, as the information may become available; methods of keeping down dust, considering road crossings and station grounds as well as track; waterways, channels and bank protection. C. M. McVay, division engineer, New York Central Lines, Charleston, W. Va.

Ballast—Revision of the specifications for stone ballast; ballasting by contract; the shrinkage of ballast; revision of specifications for washed gravel ballast; cost of track maintenance with different kinds of ballast, considering various conditions such as traffic, speed, roadbed, climate and cost of production. F. J. Stimson, chief engineer maintenance, Southwestern region, Pennsylvania System. St. Louis, Mo.

Ties—Substitute ties, including design; ties of foreign woods in this country; specifications for tie plugs, anti-splitting devices for ties; the extension of service test records for the purpose of furnishing information for the study of the economics of ties, conferring with the Committee on Wood Preservation. W. A. Clark, chief engineer, Duluth & Iron Range, Duluth, Minn.

Rail—Details of mill practice and manufacture as they affect rail quality; methods of reporting rail failures; transverse fissures; the comparative wear of various weights of rail under similar traffic conditions; rail canting, collaborating with Committee on Track; the advisability of lubrication of contact surfaces between joints and rail, together with the effect of various bolt tensions on the mechanical strength of joints and resistance to slip; the design of track bolts; the cause and prevention of rail battering, with a discussion as to the principles of rail joint design, collaborating with Committee on Track; the welding of traction bonds and signal bonds; the determination of the maximum permissible wheel loads on steel rail imposed by passage of wheels of various diameters; the establishment of limits of rail wear on curves for various classes of traffic and wheel loads. G. L. Moore, engineer maintenance of way, Lehigh Valley, Bethlehem, Pa.

Track—Detail plans of switches and frogs, crossings and slip switches, conferring with Committee on Signals and Interlocking; the design of wooden handles for track tools; the effect of brine drippings on track appliances and tests of tie plates subject to brine drippings; the canting of rail inward and the taper of the tread of wheels, conferring with Committee on Rail and with Committee E, Division V—Mechanical, A. R. A.; methods of determining recommendations for rail renewals; the resawing and reconditioning of rails for relaying, and the building up of battered rail ends in the track, conferring with the Rail Committee; plans of tie plates; collaborate with Rail Committee on cause and prevention of rail battering, with discussion as to principles of rail joint design; track construction in and across paved streets and highways; the value of nutlocks for rail joints, with special reference to heat treated bolts of large diameter. W. P. Wiltsee, chief engineer, Norfolk & Western, Roanoke, Va.

Buildings—Freighthouse design; specifications for buildings for railway purposes; ventilation of railway buildings, except enginehouses; ornamental roof coverings for passenger stations; location and design of signs for passenger stations. W. T. Dorrance, designing engineer, New York, New Haven & Hartford, New Haven, Conn.

Wooden Bridges and Trestles—The useful strength of new, old and treated timber when used in railway trestles, including a critical examination of the present theories of stresses when applied to timber under railway load conditions; the classification of uses of timber and lumber under American Railway Engineering Association specifications; the relative merits of open and ballast deck trestles. A. O. Ridgway, chief engineer, Denver & Rio Grande Western, Denver, Colo.

Masonry—The principles of design of concrete, plain and reinforced, for use in railroad structures; representation of the association on the Joint Committee on Concrete and Reinforced Concrete; representation of the association on the Joint Committee on Standard Specifications for Concrete Pipe; developments in the art of making concrete; co-operation with Committee on Marine Piling Investigation of the National Research Council; specifications for various aggregates used for concrete, collaborating with producers to bring about better and more uniform products. C. C. Westfall, engineer bridges, Illinois Central, Chicago.

Signs, Fences and Crossings—The various substitutes for wooden crossing planks for the crossing of highways and city streets, with specifications for bituminous crossings; methods of apportioning cost of street and highway improvements adjacent and parallel to railroad rights-of-way; the elimination of highway grade crossings; plans for end, corner and gate posts of concrete and a method of bracing the same; improved methods of preventing corrosion of fence wire. T. E. Rust, chief engineer, Waterloo, Cedar Falls & Northern, Waterloo, Iowa.

Signals and Interlockings—Assistance of other committees in work which involves signaling; automatic train control; signals for highway crossing protection. F. B. Wiegand, signal engineer, New York Central, west of Buffalo, Cleveland, Ohio.

Records and Accounts—Cost-keeping methods and statistical records; plans, methods and forms for gathering and recording data for keeping up to date the physical and valuation records of the property of railways; the feasibility of reducing the number of forms used in the engineering and maintenance of way departments, combining forms and simplifying those retained; methods for recording and accounting for the determination of proper allowance for maintenance of way expenses due to increased use and increased investment, collaborating with the Committee on Economics of Railway Operation; revision of the I. C. C. Classification of Accounts; comparison of daily and monthly time and material reports. H. M. Stout, record engineer, Northern Pacific. St. Paul, Minn.

Rules and Organization—The preparation of a Manual of Rules for the guidance of employees of the maintenance of way department. W. C. Barrett, trainmaster, Lehigh Valley, Sayre, Pa.

Water Service—The regulations of federal and state authorities pertaining to drinking water supplies and the sanitary examination of drinking water supplies; the pitting and corrosion of boiler tubes and sheets, taking into consideration character of metal used, method of manufacture, construction of boilers and quality of water; the cost of impurities in locomotive water supply and the value of water treatment with comparison of the different methods and a study of the costs of blowing off, washouts and water changes; lead as compared with substitutes for joints in cast iron pipe; the relative merits of the different methods of deep well pumping; the possibilities of the use of hydraulic rams for railway water supplies; the relative economy of different methods of obtaining water, considering the use of steam, electricity and oil pumping outfits and the purchase of water as compared to pumping; the design, construction and maintenance of pipe lines. C. R. Knowles, superintendet water service, Illinois Central, Chicago.

Yards and Terminals—Unit operation of railway terminals in large cities, including a revision of catechism of unit operation of terminals as a statement of principles; scales—(a) automatic indicating devices for weighing, (b) tolerances for railroad service weighing devices; freight handling at two-track freighthouses and team tracks and multiple-story freighthouses, also handling freight by mechanical means, including the relative advantages and disadvantages of the use of freighthouses as warehouses in connection with l. c. l freight; freight yard design, suggesting economies in operation; the arrangement of terminals to reduce preparatory leaving time and terminal arriving of trains, including the matter of main track capacity approaching important terminals; the proper size and arrangement of large passenger station facilities as determined by the business handled. J. R. W. Ambrose, chief engineer, Toronto Terminals Railway, Toronto, Ont.

Iron and Steel Structures—Revision and final report on specifications for steel highway bridges; the electric welding of connections in steel structures; rules for lighting bridges and a uniform code of regulations and signals for the operation of drawbridges, conferring with Committee on Signals and Interlocking; the maintenance of railway bridges, including equipment for that purpose; rules for field inspection of existing bridges, working with Committee on Rules and Organization; investigations and tests on I-beams connected in groups by diaphragms and bracing; tests and study of the behavior of bridge pins; column tests; methods of waterproofing and draining solid floor bridges, with specifications, conferring with the Committee on Masonry. O. F. Dalstrom, engineer of bridges, Chicago & North Western, Chicago.

Economics of Railway Location—The economics of railway location as affected by the introduction of electric locomotives, conferring with the Committee on Electricity; suitable units for comparing cost of maintenance of way, equipment and transportation, conferring with the committees on Records and Accounts and Economics of Railway Operation; locomotive tractive force, collaborating with the appropriate committee of Division V—Mechanical, of the American Railway Association; methods of estimating speed, time and fuel consumption, collaborating with the appropriate committees of Division V—Mechanical, of the American Railway Association; the relative merits of increasing tonnage by the reduction of ruling grades, or by the introduction of more powerful locomotives, including the consideration of momentum grades and the availability of the locomotive booster. E. E. King, professor railway civil engineering, University of Illinois, Urbana, Ill.

Wood Preservation—The treatment of Douglas fir; service test records, providing data for the use of the Committee on Ties, after conferring with that committee; co-operation with the Committee on Marine Piling Investigation of the National Research Council; the preservative treatment of signal trunking and capping, working with the Committee on Signals; the effect of preservatives on the inflammability of woods; treatment with a mixture of creosote and petroleum oil; treatment with a mixture of zinc chloride and petroleum oil. S. D. Cooper, assistant manager treating plants, Atchison, Topeka & Santa Fe, Topeka, Kan.

Electricity—Interference with signal, telephone and telegraph lines by propulsion circuits and adjacent transmission lines, with recommendations for its elimination; representation on the American Committee on Inductive Co-ordination and collaboration with committees of the Telegraph and Telephone Section and the Signal Section with the view of submitting a joint report to the American Railway Association; the utilization of water power for electric railway operation with particular reference to the future developments of water power from the Saguenay and the St. Lawrence rivers; collaboration with the American Committee on Electrolysis; collaboration with the U. S. Bureau of Standards in the revision of the National Electrical Safety Code and other codes of similar character; specifications for electric light, power supply and trolley lines crossing railways, recommending changes which may be desirable in the adopted specifications, to make them conform more nearly with the requirements of Part 2 of the National Electrical Safety Code prepared by the U. S. Bureau of Standards and with the requirements of public service commissions and other regulatory bodies in various states; continuing the state representatives and their alternates; specifications for the construction of overhead electric supply lines for railroad use on railroad property, collaborating with the appropriate committees of the Signal Section and the Telegraph and Telephone Section, with the view of submitting joint specifications to the American Railway Association; the economics of railway location as affected by electric operation, co-operating with Committee XVI—Economics of Railway Location; specifications for adhesive tapes, recommending any changes which may be desired to conform with similar specifications of the American Society for Testing Materials; specifications for porcelain insulators for railroad supply lines, collaborating with the appropriate committees of the Signal Section and the Telegraph and Telephone Section with the view of submitting joint specifications to the American Railway Association; the protection of oil sidings from danger due to stray currents, co-operating with appropriate committees of other interested associations. Edwin B. Katte, chief engineer, electric traction, New York Central, New York City.

Uniform General Contract Forms—Form of option for purchase of land; form of agreement for purchase of electrical energy; form of agreement for joint use of passenger facilities; form of agreement for joint use of freight facilities; form of agreement for joint pole lines; form of agreement for furnishing water from railway water systems to employees or others; form for contract for purchase of water; contract for grading. W. D. Faucette, chief engineer, Seaboard Air Line, Norfolk, Va.

Economics of Railway Operation—Effect of speed of trains upon the cost of transportation; methods of increasing the traffic capacity of a railway; methods of analyzing costs for the solution of special problems, including a study of the costs of starting and stopping trains; feasibility and economy of through routing of solid trains and its effect upon the capacity of terminals; methods for the determination of proper allowances for maintenance of way expenses due to increased use and increased investment; the utilization of locomotives to determine: (a) the percentage of time they should be available to perform actual transportation; (b) methods for obtaining maximum efficiency while so available; collaborating with other divisions and sections of the American Railway Association. G. D. Brooke, superintendent transportation, Baltimore & Ohio, Western Lines, Cincinnati, Ohio.

Economics of Railway Labor—Standard methods for performing maintenance-of-way work and establishment of units of measure of work performed; methods of programing maintenance-of-way work looking to the most economical application of labor; the establishment of standards and units of measure of work performed, particularly considering quality and economy, with their application to maintenance-of-way work. C. C. Cook, maintenance engineer, Baltimore & Ohio, Baltimore, Md.

Shops and Locomotive Terminals—General layouts of engine terminals; general layouts and designs of car shops; general layouts and designs of coaling stations; storehouses for shops and locomotive terminals; the ventilation of engine-houses; general layout and design of typical locomotive repair shops. E. E. Morrow, assistant chief engineer, Chicago & Western Indiana, Chicago.

Co-operative Relations with Universities—A greater interest upon the part of railroad officers in assisting the universities to develop the best possible methods for the technical courses; a better means of bringing to the universities the results of our deliberations, where such can be made of value to them; a better means of building to the attention of the railroads the benefits of a technical education, thereby acquainting them with the qualifications of graduates of these courses for initial service in subordinate positions, and at the same time providing material from which men may be drawn for higher positions as they demonstrate their fitness; a means of stimulating a greater interest in the science of transportation among engineering students who may be inclined toward this branch of industry; a means whereby the facilities of the universities may be made more directly available for the research work of the association by co-operative effort between their laboratories and the committees of the association; a means whereby the universities may be better enabled to educate the students and the public regarding the value of transportation to the nation as a whole; a means of stimulating a greater interest among university officials in the study of transportation and economics and impressing them with the importance of experienced men for such teaching. R. H. Ford, assistant chief engineer, Chicago, Rock Island & Pacific, Chicago.

Stresses in Railroad Track—Continue work now already in progress; prepare a short digest of results already accomplished by this committee; assist Committees on Ties, Track and Rail in subjects assigned to them; make recommendations as to undertaking a series of tests to determine best methods of testing steel rails. A. N. Talbot, professor of municipal and sanitary engineering, and in charge of theoretical and applied mechanics, University of Illinois, Urbana, Ill.

Standardization—E. A. Frink, principal assistant engineer, Seaboard Air Line, Norfolk, Va.

Clearances—O. F. Dalstrom, engineer of bridges, Chicago & North Western, Chicago.

Directory of Associations

American Railway Bridge and Building Association.—C. A. Lichty, secretary, C. & N. W. Ry., 319 North Waller Ave., Chicago. Next convention Kansas City, Mo. October 14-16, 1924. Exhibit by Bridge and Building Supply Men's Association.

American Railway Engineering Association (Works in co-operation with the American Railway Association, Division IV).—E. H. Fritch, secretary, 431 South Dearborn St., Chicago. Annual convention, Congress Hotel, Chicago, March 11-12, 1925. Exhibit by National Railway Appliances Association.

American Wood Preservers' Association.—P. R. Hicks, secretary, Room 1146, Otis Bldg., Chicago. Next convention, January 27-29, 1925, Chicago.

Bridge and Building Supply Men's Association.—John Nelson, secretary, Joseph E. Nelson & Sons, 3240 South Michigan Ave., Chicago. Exhibit in connection with annual convention of American Railway Bridge and Building Association.

National Association of Railroad Tie Producers.—J. S. Penney, secretary, T. J. Moss Tie Company, St. Louis, Mo. Next convention, January 29-30, 1925, Chicago.

National Railway Appliances Association.—C. W. Kelly, secretary, Peoples' Gas Bldg., Chicago. Annual exhibit at Coliseum, Chicago, in connection with convention of American Railway Engineering Association.

Roadmasters' and Maintenance of Way Association.—P. J. McAndrews, secretary, C. & N. W. Ry., Sterling, Ill. Next convention, Commodore Hotel, New York, September 16-18, 1924. Exhibit by Track Supply Association.

Track Supply Association.—W. C. Kidd, secretary, Ramapo-Ajax Corporation, Hillburn, N. Y. Exhibit in connection with convention of Roadmasters' and Maintenance of Way Association.

The Material Market

THE present situation in the material market may be characterized as one of extreme caution, caution on the part of the buyers to distribute their purchases throughout the year so as to enable them to take advantage of the most favorable prices from month to month and caution on the part of the manufacturers to insure a thorough balance of production against demand. Therefore, while the present aspect is not entirely favorable it is believed that the observance of this policy will srve to stabilize conditions during the later months.

The tendency at present is toward decreased production and lower prices. These reductions have not yet become manifest in the case of track supplies but are rather widely current in the case of structural material and it must also be said that the prices shown in the table below do not reflect the full effect of the downward tendency.

	March 20.		April 20.	
	Pittsburgh.	Chicago.	Pittsburgh.	Chicago.
Track spikes	$3.00 to $3.15	$3.10	$3.00	$3.10
Track bolts	4.00 to 4.25	4.10	4.00 to 4.25	4.10
Angle bars	2.75	2.75	2.75	2.75
Tieplates, steel	2.60	2.60	2.55 2.60	2.60
Boat spikes	3.25 to 3.50	3.59 to 3.84	3.25 to 3.50	3.59 to 3.84
Plain wire	2.75	3.09	2.75	3.09
Wire nails	3.00	3.34	3.00	3.34
Barbed wire, galv.	3.80	4.14	3.80	4.14
C. I. pipe 6 in. to 12 in., per ton		56.20		56.20
Plates	2.30 to 2.50	2.60	2.20 to 2.40	2.50
Shapes	2.40 to 2.50	2.60	2.30 to 2.40	2.50
Bars, soft steel	2.40	2.50	2.25 to 2.40	2.40
Rivets, structural	2.75	3.09	2.65 to 2.75	2.99 to 3.09
Open hearth rail, per gross ton, f. o. b. mill				$43.00

The tendency of scrap prices is still definitely downward, as will be observed in the table of scrap prices below:

PRICES PER GROSS TON AT CHICAGO

	March.	April.
Relaying rails	$27.00 to $32.00	$27.00 to $32.00
Rails for rerolling	19.00 to 19.50	16.50 to 17.00
Rails less than 3 ft. long	20.00 to 20.50	17.00 to 17.50
Frogs and switches cut apart	17.50 to 18.00	14.50 to 15.00
Steel angle bars	18.50 to 19.00	16.50 to 17.00

The prices of lumber still show a tendency towards weakness but perhaps not to such a marked extent as was the case a month ago. The demand for lumber is considerably less than it was a year ago and there has also been a considerable curtailment of production. The prices for certain lumber items given below show considerable variations from the previous months, but without any marked tendency in either direction.

SOUTHERN PINE MILL PRICES

	March.	April.
Flooring, 1x4, B and B flat	$45.80	$46.20
Boards, 1x8, No. 1	35.50	38.40
Dimensions, 2x4, 16, No. 1, common	28.35	28.15
Dimensions, 2x10, 16, No. 1, common	30.75	29.80
Timbers, 4x4 to 8x8, No. 1	30.65	28.90
Timbers, 3x12 to 12x12, rough	36.15	38.40

DOUGLAS FIR MILL PRICES

Flooring, 1x4, No. 2, clear flat	$32.00	$32.00
Boards, 1x8, 6 to 20, No. 1, common	19.50	19.50
Dimensions, 2x4, 16, No. 1, common	17.50	17.50
Dimensions, 2x10, 16, No. 1, common	18.00	18.00
Timbers, 6x6 to 8x8, No. 1, common	23.00	23.00
Timbers, 10x10 to 12x12, rough	22.00	21.00

Portland cement prices are practically stationary. Such changes as have taken place are downward on a moderate basis. The following prices are for Portland cement in carload lots, not including package.

Chicago	$2.20	Boston	$2.63
Cincinnati	2.47	Buffalo	2.48
Davenport	2.39	New York	2.25
Minneapolis	2.42	Philadelphia	2.41
Pittsburgh	2.19	Richmond, Va.	2.47

PROGRESS ON ST. PAUL STATION—The third section of the passenger terminal construction project in St. Paul, Minn., has been completed and is now in use.

News of the Month

Eight employees of the Atchison, Topeka & Santa Fe who were responsible for the detention of passenger trains at Needles, Cal., in extremely hot weather during the shopmen's strike in August, 1922, have been fined $1,200 each as the result of a suit brought in the courts.

Following the completion of 115 miles of second track between Yampi, Ariz., and Topock, the Atchison, Topeka & Santa Fe has installed automatic signals in connection with which all main line switch lamps are lighted electrically. The signal power line also furnishes electricity for operating water supply facilities.

Shower baths for men, shower baths for women, a women's smoking and retiring room, a hairdresser and a soda fountain will be provided on the Oriental Limited of the Great Northern and the Chicago, Burlington & Quincy, between Chicago and the Pacific coast beginning June 1, when this train will consist of new cars throughout.

The earnings of Class I railroads (operating 235,900 miles of railway) in February, 1924, were at the annual rate of return of 6.28 per cent on their tentative valuation, according to the Bureau of Railway Economics. The net operating income was $71,991,600, as compared to $39,274,900, or an annual rate of return of 3.76 per cent, in February of 1923.

As a means of preventing waste in the use of equipment and supplies and of promoting greater economy in all lines of work, the Chicago, Burlington & Quincy has inaugurated an economy program, a feature of which is the co-ordination of all forces on each division by means of division committees, each consisting of the division superintendent as chairman and the division officers of the engineering, mechanical and stores department as members.

A total of 172 bills and resolutions proposing new railroad legislation or the repeal of laws now in effect have been introduced in Congress up to April 12. The great majority of these bills, if passed, would have the effect of reducing railroad revenues or increasing expenses, or both, and few are considered to be in any way in the interests of the railroads. No railroad bill has yet been passed by Congress at this session. A total of 27 of the bills introduced involve labor questions.

The Class I roads handled 2,333,787,044 tons of freight during 1923, of which 1,250,314,752, or over 50 per cent, consisted of products of the mines, while 220,518,087 tons, or slightly over nine per cent was made up of products of agriculture, leaving 517,915,274 tons of manufactured and miscellaneous material and 222,570,867 tons of forest products. The amount of freight originating on Class I roads consisted of 1,277,318, 731 tons. In both cases the tonnage exceeded that of any preceding year.

The Interstate Commerce Commission has denied the petition of a committee of railway executives to conduct a rehearing of its automatic train control proceedings in which 47 of the 49 railroads included in the first order to equip a division with automatic control were ordered to equip a second division. The Commission has granted, however, a hearing to 45 roads mentioned in the second order, but which were not included in the original order. This hearing will be held on May 7 at Washington.

The United States Supreme Court has held that a state commission has no power to order the construction of a Union station involving railroads engaged in interstate commerce. This decision was handed down after a hearing on the order of the Railroad Commission of California, requiring the Atchison, Topeka & Santa Fe, the Southern Pacific and the Los Angeles & Salt Lake to build a new Union station in Los Angeles and to remove grade crossings at a cost of from $25,000,000 to $45,000,000. Power of this sort, it is held, reposes solely in the Interstate Commerce Commission.

Between 40,000,000 and 50,000,000 meals are served annually in the dining cars on American railways, according to the Bureau of Railway Economics, after a study of conditions on the 60 railroads maintaining dining car service. The cost of dining car operation is given by one middle western railroad and comprises the following items: Laundry bills, 4 cents for each person patronizing the car, cost of crew, 40 cents for each person served, fuel and ice, 5 cents per person and other items of expense, 27 cents per person, these expenditures being separate and apart from 76 cents to cover the cost of the food served.

The Chesapeake & Ohio has several new Mallet locomotives in service which measure 109 ft. from the front of the engine to the rear of the tender and have a total weight of 775,000 lb. with the tender loaded. The distribution of the weight is 32,000 lb. on the front trucks, 251,500 lb. on the forward set of drivers, 239,500 on the second set of drivers and 42,000 lb. on the trailing truck, making the total weight of the engine alone 565,000 lb. The engine exclusive of the tender is 70 ft. long. The headlight of the engine is carried on the pilot. A ventilating system is provided in the cab for the comfort of enginemen when passing through tunnels.

The railroad pay roll for 1923 exceeded the $3,000,000,000 mark for the first time, according to a bulletin on wage statistics for the year issued by the Interstate Commerce Commission. The total compensation of officers and employees during this year amounted to $3,043,161,163. Of this amount, $59,409,516, or 15.4 per cent, of the total expenditure comprised the compensation of maintenance of way and structure forces. The number of employees, including switching and terminal work, was 1,879,770, based on the average number of employees at the middle of the month. This is 14.3 per cent above the average for the preceding year, while the total compensation represents a 14 per cent increase.

The Committee on Simplication of Varieties and Standards of Vitrified Paving Brick has made a further reduction in the recognized types and sizes of vitrified paving brick from six to five. The types and sizes which have finally been recognized by the committee through the process of elimination extending over a period of three years are as follows:

Type.	Depth, Inches.	Width, Inches.	Length, Inches.
Plain wire cut brick (vertical fiber)	3	4	8½
	3½	4	8½
Repressed lug brick	4	3½	8½
Wire cut lug brick (Dunn)	3	3½	8½
	4	3½	8½

Group life insurance is now in force on at least 27 railroads in the United States (not counting subsidiary companies) and for the benefit of over 200,000 employees. The aggregate face value of the policies is upwards of $260,000,000. The greater part of these policies have been put into effect within the last 18 months. The plans under which the insurance has been issued include simple life insurance, life insurance modified to provide also for total disability and life and accident insurance combined. There are also varied provisions concerning the amounts of insurance, the benefits, etc.

Labor News

Railway Association of Canada Grants Concession to Railway Employees

An agreement has been reached between the wage sub-committee of the Railway Association of Canada and the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers in regard to working conditions for about 30,000 men employed in the maintenance of way and bridge departments of Canadian railroads. This agreement covers the granting of time and one-half for all overtime in excess of eight hours, overtime to be figured on the actual minute basis. A change in the rule also provides that employees in positions not requiring continuous manual labor, who, under the old rules may be assigned to work in excess of eight hours on a pro rata basis, restricts such overtime employment to a maximum of 12 hours and requires that time and one-half on the actual minute basis will be paid for work performed after and continuous with the assigned hours.

Clauses relating to the rates of pay for plumbers, pipe fitters, tinsmiths, blacksmiths and pump repairers on the basis of the number of years experience have been amended to provide that four or more years' experience as a helper with the railway on which employed will count upon promotion to the mechanic classification as two years' experience as a mechanic. The clause providing for the rate of 60 cents per hour for carpenters after one year's experience on the railway has been amended to provide that the same rate will hold providing that evidence of one year's experience elsewhere is presented.

Another change in the rules provides that in case of a reduction of force, carpenters and bridge men who may take jobs as laborers and remain in the service the year round, as well as laborers in the bridge and building department who are employed the year round, will be paid 37 cents per hour. The new agreement will remain in effect for one year and shall not be changed thereafter unless on 60 days' notice from either party.

Wage Increase for Crossing Watchmen and Drawbridge Tenders

The New York, New Haven & Hartford and the Central New England have awarded increases in wages of 1½ cents per hour to crossing watchmen, drawbridge tenders and assistants. The increase was made effective March 14 and will continue for one year from that date.

Decisions of the Labor Board

The following are abstracts of recent decisions of the United States Railroad Labor Board which concern employees of the maintenance of way department or are otherwise of interest to those engaged in maintenance or construction work.

Grading Contractors Train on Main Track Must Be Operated By Train Service Men

The four train service brotherhoods brought a case before the labor board with respect to the operation of trains of the Walsh Construction Company over seven miles of the St. Louis-San Francisco's main track in Oklahoma in connection with the filling of a bridge. This work was let to the contractor on the basis of a yardage price for the filling, the contractor operating the train with his own men. The railway management contended that the contract included the furnishing of all necessary equipment and labor and was permissable since the carrier has an inherent right to contract the use of its rails for legitimate purposes. It also claimed that the work was of extraordinary character and not included in the agreement with the employees covering work train service. The train service men, on the other hand, contended that this work originated in their seniority territory and rightfully belonged to them under the work train guarantee of the contracts between the railroad and the brotherhoods.

The decision of the board was that engineers, firemen, brakemen and conductors in the employ of the carrier should be used to perform this work train service and that such of the employees of the carrier as were deprived of work should be paid for the time lost by them at the rates of the agreement by reason of the contractor using his own employees on the work train. (Decision No. 2144.)

Contracting of Coal Chute Operation

In a case brought before the labor board by the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers in connection with the operation of coal chutes on the Chicago & North Western, it was shown that Frank Tierney had served in the capacity of a coal chute foreman at Dunlap, Iowa, until March 1, 1921, when the operation of the chute was taken over by a contractor. Mr. Tierney remained in the service of the contractor for nine days, when he was discharged on account of his alleged refusal to carry out the instruction of the contractor. It is claimed that he had refused to perform certain manual labor in connection with the operation of the chute and continued to perform only certain supervisory duties which the carrier contended required service not to exceed one hour per day. The employees contend that Mr. Tierney did not refuse to carry out the instructions of the contractor and that it did not seem reasonable that an employee after 16 years' satisfactory service for the carrier should become inefficient and unsatisfactory to his new employer in only nine days' time and contend that his dismissal must have been for other reasons.

The opinion of the board is that his 16 years of service for the North Western without complaint indicates that he must have been a satisfactory employee. The board also took cognizance of the fact that the contract entered into for the operation of the coal chute at Dunlap when his discharge took place, was in violation of the Transportation Act of 1920. The decision of the board, therefore, is that Frank T. Tierney be reinstated to his former position as coal chute foreman with seniority rights unimpaired and pay for all time lost, less any amount he may have earned if and while engaged in other employment. (Decision No. 2313.)

Coal Chute Employees Entitled to Restoration of Position and Pay for Time Lost

Another case involving a coal chute on the Chicago & North Western was brought before the labor board by the United Brotherhood of Maintenance of Way Employees with respect to four coal heavers employed at a coaling station at Green Bay, Wis. The evidence shows that on March 1, 1921, the operation of the coal chute at Green Bay was let out by contract. A discrepancy in the evidence leaves undetermined whether the men were refused employment with the contractor or whether they quit upon learning that the rate paid by the contractor was less than that which they had been receiving from the railroad. It is clear, however, that they were not consulted with respect to the changed arrangement nor with the reduction in pay. The decision of the labor board is that the work done by these men was contracted in violation of the Transportation Act and that the men were within their rights in refusing to accept employment with the contractor. Accordingly, the order of the board is that the men be reinstated in their former positions as coal heavers with seniority rights unimpaired and with pay for all the time lost, less any amount which they may have earned if and while engaged in other employment. (Decision No. 2314.)

Rights of Foremen to Hold Membership in Brotherhood

On February 2, 1922, the United Brotherhood of Maintenance of Way Employees and Railway Shop Laborers filed an ex parte submission with the board protesting the failure of the Butler County railroad to carry out the provisions of Decision No. 224, which provided for the restoration to the service of two section foremen. These two foremen were discharged from the service on December 18, 1920, on the grounds that they belonged to the same labor union to which the men under them belonged, and maintained that this reason was just as sufficient and necessary for the economic interests of the public and of the corporation. In its decision No. 224, dated September 12, 1921, the board decided that the action of the carrier in discharging these two foremen was unfair, unjust and unreasonable and ordered that the men be reinstated. On the evidence submitted on February 2, 1922, the board decided that the Butler County railroad and its responsible officers have violated decision No. 224 on account of its refusal to comply with the provision thereof. (Decision No. 2315.)

Personal Mention

General

G. C. Jefferis, division engineer on the Atchison, Topeka & Santa Fe at Clovis, N. Mex., has been promoted to assistant superintendent, with headquarters at Newton, Kan.

W. R. Triem, assistant division engineer of the Logansport division of the Pennsylvania, with headquarters at Logansport, Ind., has been promoted to assistant trainmaster on the Toledo division, with headquarters at Toledo, Ohio.

Major F. L. C. Bond, chief engineer of the Central Region of the Canadian National, with headquarters at Toronto, Ont., has been promoted to general superintendent of the Central region of the Canadian National, with headquarters at Montreal, Que. Major Bond was born on February 21, 1877, at Montreal, Que., and was educated in McGill University. He entered railway service in 1898 as resident engineer on the Eastern division of the Grand Trunk, and in 1901 was appointed engineer in charge of double track construction. The following year he was appointed night superintendent on the construction of the Park avenue tunnel of the New York subway and subsequently returned to the service of the Grand Trunk as resident engineer on the Eastern division, remaining in that position until 1913. He then served as division engineer on the Eastern lines until 1916, when he went overseas with the Canadian Expeditionary Forces. On his return he became chief engineer of the Grand Trunk, Canadian National, Central Region, which position he was holding at the time of his recent promotion.

Arthur C. Needles, who has been elected president of the Norfolk & Western upon the retirement of N. D. Maher, is another railway president who began his career in an engineering capacity. He was born on January 10, 1867, at Baltimore, Md., and entered railway service immediately after graduating from Swathmore College in 1884, as a rodman on survey work on the Washington, Ohio & Southern. His association with the Norfolk & Western began a year later, where his first employment was also that of a rodman. Thereafter he served as a rodman, yard clerk and as a brakeman until 1884, when he became a yardmaster. Thereafter Mr. Needles continued in the operating department, being vice-president in charge of operation at the time of his election to president.

George A. Harwood, formerly corporate engineer and lately assistant to the president of the New York Central Lines, has been elected vice-president in charge of improvements and development. Mr. Harwood was born on August 29, 1875, at Waltham, Mass., and studied at Tufts College, where he received the degree of M. S. in civil and electrical engineering in 1901. He began railroad work in 1893 in the engineering department of the Fitchburg Railroad (now a part of the Boston & Maine), and with the exception of the time spent in college, he remained with that road until 1900 when he entered the service of the New York Central in the engineering department. On November 1, 1906, he was appointed chief engineer of improvements in the electric zone and was in charge of the construction of Grand Central Terminal and general improvements on the lines under electrification in the metropolitan area, later handling in addition special work in connection with other improvements and developments in New York City, Buffalo, Cleveland, and other places. On July 1, 1916, he was appointed engineering assistant to the vice-president of the New York Central Lines and on June 10, 1918, engineering assistant to the federal manager of the New York Central Railroad. The following July he was appointed corporate chief engineer of the system, and in February, 1920, became assistant to the president of these properties, in which position he was serving at the time of his election to the vice-presidency.

George A. Harwood

Raymond D. Starbuck, assistant vice-president of the New York Central Railroad, and an engineer by education, has been elected vice-president in charge of operation of the New York Central Lines, succeeding P. E. Crowley, who has been elected president. Mr. Starbuck was born on July 26, 1878, at Fort Ann, N. Y., and studied engineering at Cornell University. He entered railway service in January, 1903, as an assistant engineer on the Michigan Central. In June of the following year he was promoted to division engineer, and a year later was appointed assistant chief engineer. He was appointed special engineer to the assistant vice-president of the New York Central Lines in 1912 and in April of the following year was promoted to special engineer to the vice-president. In May, 1916, he was promoted to assistant to the vice-president and in February of the following year he became assistant general manager of the lines west of Buffalo. He has been assistant vice-president of the New York Central since federal control.

Raymond D. Starbuck

J. E. Crawford, formerly chief engineer of the Norfolk & Western, has been promoted from assistant general manager to general manager, effective May 1. Mr. Crawford was born on September 1, 1876, at San Diego, Cal., and received his early engineering education at the University of Pennsylvania, from which he was graduated in 1897. Prior to finishing his collegiate studies he was employed intermittently as a draftsman on foundry work with the Pencoyd Iron Works. Later he was associated with this company as a designer. His entrance into railway service occurred in July, 1903, when he became acting bridge engineer of the Norfolk & Western. He was subsequently promoted to bridge engineer and held this position until May, 1913, when he was promoted to acting chief engineer. In February, 1914, he was promoted to chief engineer, which position he relinquished in 1923 to become assistant general manager.

J. E. Crawford

J. H. Nuelle, former chief engineer on the New York, Ontario & Western, has been promoted from general manager to vice-president, with headquarters at New York. Mr. Nuelle was born on April 9, 1881, at Chicago, and graduated from Princeton University in 1906. He entered railway service on June 10, 1905, as a transitman on the Pennsylvania, where he remained until February 10, 1907, when he became a transitman on the New York Central & Hudson River. He entered the service of the New York, Ontario & Western

on December 1, 1911, as an assistant engineer and continued in this capacity until January 1, 1912, when he was promoted to principal assistant engineer. From January 1, 1912, to July 1, 1913, he was engineer maintenance of way and on the latter date was promoted to chief engineer, which position he held until December 1, 1915, when he also assumed the duties of assistant general superintendent. From December, 1916, to June, 1919, he was general superintendent, since which time he has been general manager.

C. F. Millard, formerly engineer maintenance of way and recently assistant general superintendent of the Cleveland, Cincinnati, Chicago & St. Louis, has been promoted to general manager. Mr. Millard was born on May 3, 1874, and after graduating from Sheffield Scientific School, Yale University, in 1896, he entered railway service as a rodman on the Pennsylvania. In March, 1897, he was appointed assistant in the engineering department of the Peoria & Eastern, and was promoted in July of the following year to assistant engineer. In 1899 he was promoted to engineer maintenance of way of this road and held this position until March, 1901, when he became second assistant engineer of the Delaware, Lackawanna & Western. He was appointed engineer maintenance of way of the Peoria & Pekin Union in August, 1901, and in August, 1903, he was appointed assistant engineer on the Illinois Central at Memphis, Tenn. Entering the service of the Cleveland, Cincinnati, Chicago & St. Louis in August, 1903, he was division engineer maintenance of way and subsequently engineer of track and roadway until October, 1912, when he was promoted to superintendent. He became assistant general superintendent in June, 1918.

C. F. Millard

R. W. Simpson, formerly assistant chief engineer of the Intercolonial, has been advanced from assistant to general manager of the Atlantic region of the Canadian National to assistant general manager, with headquarters at Moncton, N. B. He was born in Scotland, but received his education in Canada, where he graduated from the Royal Military College at Kingston, Ont., in civil engineering. He entered railway service on July 22, 1889, as an employee in the chief engineer's office of the Intercolonial, now a part of the Canadian National, where he remained until August, 1902, when he was promoted to assistant chief engineer. In August, 1902, he was attached to the staff of the general manager and in June, 1909, he became advisory engineer to the board of management. Upon the co-ordination of all government-owned lines into the Canadian National in March, 1923, he was appointed assistant to the general manager of the Atlantic region, which position he held at the time of his recent promotion.

Engineering

W. C. Pinschmidt and **C. H. Zentmyer** have been appointed assistant engineers on the Chesapeake & Ohio.

Lawrence Spalding, assistant valuation engineer of the Bessemer & Lake Erie, with headquarters at Greenville, Pa., has been promoted to the newly created position of valuation engineer, with the same headquarters.

W. N. Burnett, district engineer on the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Springfield, Ohio, has been promoted to engineer of construction, with headquarters at Indianapolis, Ind., a newly created position, where he will take over the duties of **A. M. Turner,** district engineer at Indianapolis, Ind., who has resigned.

T. T. Irving, chief engineer of the Grand Trunk, Western Lines, with headquarters at Detroit, Mich., has been transferred to the Central region of the Canadian National, with headquarters at Toronto, Ont., succeeding F. L. C. Bond, promoted, as noted elsewhere.

Carl C. Witt, assistant supervising engineer in the Bureau of Valuation of the Interstate Commerce Commission, with headquarters at Washington, D. C., has been promoted to supervising engineer, succeeding **Howard M. Jones,** an announcement of whose death appears elsewhere in these columns.

Gordon Grant has been appointed principal assistant engineer of the Central region of the Canadian National, with headquarters at Toronto, Ont., and **H. T. Hazen,** assistant chief engineer of the Central region, has been transferred to Montreal as assistant chief engineer, operating department, his former position having been abolished.

H. R. Kreigh, instrument man on the Plains division of the Atchison, Topeka & Santa Fe at Amarillo, Tex., has been promoted to office engineer of the Pecos division, with headquarters at Clovis, N. Mex., to succeed **George D. Hickok,** who has been promoted to roadmaster, as noted elsewhere. **J. B. Raymond,** roadmaster on the Gulf Coast & Santa Fe at Brownwood, Tex., has been promoted to division engineer of the Pecos division, with headquarters at Clovis, N. Mex., to succeed **J. C. Jefferis,** promoted to assistant superintendent, as noted elsewhere in these columns.

G. C. Cleveland, chief engineer of the New York Central lines west of Buffalo, with headquarters at Cleveland, Ohio, has been appointed consulting engineer with the same headquarters, having reached the age of 70 years. He is succeeded by **R. O. Rote,** heretofore assistant chief engineer, with headquarters at Cleveland. The office of assistant chief engineer has been abolished.

G. C. Cleveland

R. O. Rote

Mr. Cleveland was born in 1854 at Dover, Mass., and entered railway service in 1873 as a rodman on the Providence & Springfield, now a part of the New York, New Haven & Hartford. He left railway service in 1874, but returned in 1880 on the Mexican Central as officer in charge of location surveys. He was later promoted to assistant chief engineer in charge of construction and continued in this position until 1885, when he again left railway service for a period of six years. In 1891 he returned as principal assistant engineer of the Lake Shore & Michigan Southern, now a part of the New York Central, and in 1905 was promoted to assistant chief engineer in charge of maintenance and construction. He was promoted to chief engineer in September, 1912, and continued in that position until his recent appointment as consulting engineer.

Mr. Rote was born on March 22, 1871, at Geneva, Ohio, and entered railway service in 1889, as a rodman on the Michigan Central. He subsequently served as instrumentman, inspector and draftsman and in 1893 was appointed chief draftsman on the Lake Shore & Michigan Southern, now a part of the New York Central. He was promoted to second assistant engineer in 1899, and in January, 1905,

was promoted to principal assistant engineer. He became assistant chief engineer in September, 1912, and held this position until 1915, when the Lake Shore & Michigan Southern became a part of the New York Central, at which time he was appointed assistant chief engineer of the New York Central lines west of Buffalo, with headquarters at Cleveland, Ohio, the position he held until his recent promotion to chief engineer.

Raymond M. Jolley, office engineer on the Union Pacific, has been promoted to division engineer, with headquarters at Omaha, Neb. Mr. Jolley was born at South Bethlehem, N. Y., on January 17, 1888, and graduated from Union College in 1909. He entered railway service in December, 1909, as a rodman on the Union Pacific. From May, 1912 to October of that year, he was instrumentman, and from October, 1912, to February, 1917, was employed as an assistant engineer. He was promoted to office engineer in February, 1917, which position he held continuously until January, 1924, with the exception of eighteen months in military service and four months as acting division engineer. He was holding the position of office engineer at the time of his recent promotion.

R. Y. Barham, instrumentman on the Beaumont-Galveston division of the Southern Pacific, has been promoted to assistant engineer of the same division, with headquarters at Houston, Tex., to succeed **T. A. Palmer,** who has been promoted to roadmaster, as noted elsewhere, and **H. L. Bell,** roadmaster on the Lufkin district of the Shreveport division of the Southern Pacific, has been promoted to division engineer of the Shreveport division, with headquarters at Houston, Tex., to succeed **J. V. Lowe.** Mr. Bell was born at Edmond, Okla., on July 21, 1894, and graduated from Rice Institute in 1919. He entered the service of the Southern Pacific in November, 1919, as an employee in the valuation department and continued in this capacity until June, 1920, when he was promoted to assistant engineer on the Shreveport division, where he remained until December 21, when he was promoted to roadmaster, the position he was holding at the time of his recent promotion.

H. L. Bell

C. H. Griggs has been promoted to division engineer on the Buffalo, Rochester & Pittsburgh, with headquarters at Salamanca, N. Y., to succeed F. A. Benz, who has resigned to engage in business. Mr. Griggs was born on August 18, 1884, at Eldred, Pa. He graduated from Allegheny College in 1907 and entered railway service in the same year on the Bessemer & Lake Erie at Greenville, Pa. He was engaged in the engineering department of the Pennsylvania at Logansport, Ind., in 1910 and in December of that year became a draftsman on the Buffalo, Rochester & Pittsburgh, where he was employed consecutively as assistant engineer on construction work, assistant engineer on valuation work, assistant engineer on maintenance of way work, and assistant roadmaster until March 20, 1924, when he was promoted to division engineer.

Hadley Baldwin, assistant to the general manager of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Cincinnati, Ohio, has been promoted to chief engineer, with the same headquarters, succeeding **C. A. Paquette,** who has resigned to become president of the M. E. White Company, the White Construction Company and other affiliated companies and chairman of the board of the White Paving Company, New York and Chicago. Mr. Baldwin was born on February 24, 1867, at Marshallton, Pa. He graduated from the University of Michigan in 1893 and entered railway service in September, 1893, since which time he has been consecutively until February, 1896, masonry inspector and assistant engineer of the Cleveland, Cincinnati, Chicago & St. Louis; from February to July, 1896, supervisor of track, and from July, 1896, to January, 1897, resident engineer at East St. Louis, Ill. From January, 1897, to May, 1898, he served as supervisor of track and from May of the same year until June, 1902, was division engineer maintenance of way at Indianapolis, Ind. From June to November, 1902, he was engineer of construction at Cincinnati, Ohio, and from May, 1902, to March, 1915, served as superintendent of the St. Louis division at Mattoon Ill. In March, 1915, he was appointed assistant chief engineer, later being promoted to assistant to the general manager, which position he was holding at the time of his recent promotion to chief engineer.

Track

J. W. Shea has been appointed supervisor of the Second district of the Kent division of the Erie, with headquarters at Marion, Ohio, succeeding **J. S. Ditch,** transferred.

J. A. Farrell, roadmaster on the Chicago, Milwaukee & St. Paul, with headquarters at Murdo, S. D., has been transferred to Milwaukee, Wis., to succeed **John Garrity,** who has been transferred to Perry, Iowa, to succeed **W. E. Barnoske,** resigned.

W. H. Sparks and **W. J. Whipple,** inspectors of track on the Chesapeake & Ohio, have been given the newly created titles of general inspectors of track, and **Walter Constance** has been appointed to the newly created office of supervisor of reclamation.

H. Horn has been appointed superintendent of track, buildings and bridges of the Alaska railroad, with headquarters at Anchorage, Alaska. He will have general charge over all buildings, bridges, roadway and maintenance matters. The positions of chief engineer and engineer of maintenance and construction have been abolished and their duties assumed by **Lee H. Landis,** general manager, as announced in an earlier issue.

L. B. Holt, office engineer of the New York Central, with headquarters at Cleveland, has been promoted to engineer of track, with the same headquarters, succeeding **Charles Yoder,** who has been promoted to engineer maintenance of way, with the same headquarters, a newly-created position.

L. B. Holt

Mr. Holt entered railway service in 1894 as a rodman on the Chicago, Rock Island & Pacific. He was promoted to draftsman in 1895 and a year later to assistant engineer, which position he held until 1901, when he was promoted to division engineer on the lines in Iowa and Missouri. He was subsequently appointed division engineer of the Iowa division, serving in that capacity until 1906, when he entered the service of the Lake Shore & Michigan Southern, now a part of the New York Central, as assistant engineer. Mr. Holt was appointed office engineer to the chief engineer of the New York Central, lines west of Buffalo, with headquarters at Cleveland, Ohio, in 1917, and he continued in this position until his recent promotion to engineer of track, with the same headquarters.

B. Correll, whose promotion to supervisor on the Alabama Great Southern, with headquarters at Birmingham, Ala., was announced in the March issue, entered railway service in 1891 on the Cincinnati, New Orleans & Texas Pacific as a section laborer, serving successively as section foreman, extra gang foreman, supervisor and assistant roadmaster. On July 13, 1918, he entered the service of the Chattanooga

Station Company and on February 3, 1924, was appointed track supervisor of the Alabama Great Southern, with headquarters at Birmingham, Ala.

F. H. Bentley, supervisor on special duty on the Eastern Ohio division of the Pennsylvania, has been promoted to supervisor of track on the Eastern division of the Central region, with headquarters at Worcester, Ohio, to succeed **John Rice,** who has been retired on pension after having served 46 years in the maintenance of way department of this company. **W. E. Deubel** and **W. C. Wolfe** have been promoted to supervisors of track on the Richmond division of the Southwestern region of the Pennsylvania, with headquarters at Richmond, Ind., effective March 16, when **R. G. Yates,** acting supervisor of track, was assigned to other duties.

John D. Keiley, whose promotion to supervisor of track of the Chesapeake & Ohio, with headquarters at Russell, Ky., was announced in the March issue, was born on April 19, 1889, at Asheville, N. C., and studied electrical engineering in Brooklyn Polytechnical Institute, following which he spent one year with the Guaranty Trust Company, New York, whereupon he entered railway service as an employee in the statistical department of the New York Central. He was subsequently employed in the maintenance of way department until April, 1922, when he became an assistant engineer on the Chesapeake & Ohio, the position he was holding at the time of his recent promotion to supervisor of track.

Gustave Evert, whose promotion to the position of supervisor on the Pennsylvania, with headquarters at Logansport, Ind., appeared in the March issue, was born in Germany on July 2, 1875. He entered railway service on June 4, 1898, with the Pennsylvania at Denham, Ind., as a trackman and on May 9, 1898, was appointed section foreman at Shereville, being transferred back to Denham, Ind., on April 1, 1900. He served as extra gang foreman from September 1, 1903, until 1907, when he was appointed assistant supervisor at Logansport, Ind. On April 1, 1913, he was transferred to an extra gang, where he remained until June 13, 1922. From June 16, 1922, until January 1, 1924, he served as acting supervisor, which position he was holding at the time of his recent promotion to supervisor at Logansport, Ind.

T. A. Palmer, assistant engineer on the Beaumont-Galveston division of the Southern Pacific Lines, with headquarters at Houston, Tex., has been promoted to roadmaster at Lufkin, Tex., to succeed **H. L. Bell,** promoted to division engineer, as noted elsewhere in these columns. **R. L. Tuck,** extra gang foreman on the Houston division, has been promoted to roadmaster on the Shreveport district of the Shreveport division, to succeed **J. H. Williams.** Mr. Palmer was born on June 1, 1885, at Marietta, Ohio, and entered railway service on September 10, 1906, with the Chicago, Rock Island & Pacific at Little Rock, Ark., serving successively as tapeman, rodman, transitman and draftsman until February 4, 1911, when he was appointed section foreman at El Dorado, Ark. On June 22, 1911, he was promoted to roadmaster, and on July 6, 1912, entered the service of the Oregon Short Line as labor agent at Salt Lake City, Utah. On January 20, 1913, he became resident engineer on the Lake Erie & Northern at Brantford, Ont., which position he held until May 1, 1913, when he became assistant chief engineer. He then engaged in private business until 1916, when he returned to railway service as a draftsman on the Texas & Pacific, later serving as a special engineer and chief draftsman. He entered the service of the Texas & New Orleans on January 4, 1921, as an instrumentman and on November 1, 1921, became assistant engineer on the same road, in which capacity he was serving at the time of his recent promotion to roadmaster on the Southern Pacific Lines.

Albert A. Cross, assistant supervisor of track on the New York, New Haven & Hartford, with headquarters at Poughkeepsie, N. Y., has been promoted to supervisor of track, with headquarters at Framingham, Mass., succeeding **N. A. Schutz,** resigned. Mr. Cross was born at New Britain, Conn., on November 2, 1890, and graduated from the Sheffield Scientific School of Yale University in 1914. He entered railway service as a rodman in the engineering department of the New York, New Haven & Hartford in August of the same year, being promoted subsequently to inspector and in January, 1917, to transitman. In May, 1917, he was promoted to assistant engineer on the New Haven division, where he served until June, 1919, when he left railway service to enter the employ of the Aberthaw Construction Company. In February, 1921, he returned to the New Haven as a transitman at Taunton, Mass., where he remained until June 15, 1922, when he was promoted to cost engineer on the New London division. On December 1, 1923, he was promoted to assistant supervisor of track on the Central New England division at Poughkeepsie, the position he held at the time of his recent promotion.

Bridge and Building

W. F. Rankin, master carpenter on the Pennsylvania, Central region, with headquarters at Cambridge, Ohio, has been transferred to Uniontown, Pa., to succeed **H. B. Finlay,** transferred.

Frank Root has been promoted to general foreman of bridges and buildings and water service on the Illinois division of the Atchison, Topeka & Santa Fe, with headquarters at Chillicothe, Ill., to succeed J. Bruner, retired.

O. C. Steinmayer, supervisor of timber preservation of the St. Louis-San Francisco, with headquarters at Springfield, Mo., has resigned to take charge of treatment for the Canada Creosoting Company, with headquarters at Toronto, Ont., effective April 1. Mr. Steinmayer has been succeeded by **L. V. Michels.**

E. C. Vandenburgh, assistant general bridge inspector on the Chicago & North Western, has been promoted to supervisor of bridges and buildings, with headquarters at Madison, Wis., to succeed **F. E. Shanklin,** who has been transferred. Mr. Vandenburgh was born on March 26, 1887, at Audubon, Iowa, and graduated from Iowa State College in 1908, immediately following which he entered railway service as a tapeman on the Chicago & North Western at Winona, Minn. He was a rodman from October, 1908, to September, 1909; a draftsman from September, 1909, to March, 1910, and an instrumentman from March, 1910, to 1912, when he entered the signal department as signal inspector. In November, 1913, he was promoted to chief draftsman in the signal department and continued in this capacity until July, 1914, when he was promoted to assistant engineer on construction. He became an assistant engineer in the signal department in July, 1914, and continued in that capacity until May, 1918, when he was appointed assistant general bridge inspector.

Purchases and Stores

D. C. King, general storekeeper of the Virginian, with headquarters at Princeton, W. Va., has been promoted to purchasing agent, with headquarters at Norfolk, Va., succeeding Tom Moore, resigned. **J. H. McGlothlin** has been appointed general storekeeper, with headquarters at Princeton, succeeding Mr. King.

L. Lavoie, purchasing agent of the Central region of the Canadian National, with headquarters at Toronto, Ont., has been promoted to general purchasing agent, with headquarters at Montreal, Que. **L. C. Thomson,** chief of stores, with headquarters at Montreal, has been promoted to manager of stores, with the same headquarters. **G. W. Caye,** purchasing agent, with headquarters at Montreal, has been appointed purchasing agent of the Grand Trunk Western lines, with headquarters at Detroit, Mich.

Obituary

Joseph Emerling, supervisor of track on the Allegheny division of the Pennsylvania, Central region, with headquarters at Dunkirk, N. Y., died on March 21.

E. B. Cushing, formerly chief engineer maintenance of way of the Southern Pacific, Texas and Louisiana lines, who retired in 1920, died at Houston, Tex., on February 17. Mr. Cushing was born on November 22, 1862, at Houston, and entered railway service in January, 1879, subsequently holding various positions in the engineering department of the

Southern Pacific. In April, 1901, he was appointed engineer maintenance of way of the Southern Pacific lines in Texas and in June, 1904, he was promoted to general superintendent of the lines in Louisiana. Mr. Cushing was promoted to chief engineer maintenance of way in 1917 and held this position until his retirement in September, 1920.

H. T. Douglas, Jr., chief engineer of the Chicago & Alton, with headquarters at Chicago, and a director of the American Railway Engineering Association, died in that city on March 31 after a short illness. Mr. Douglas was born on June 16, 1863, in Richmond County, Va., and entered the railway service in 1880 as a rodman on the Georgia Pacific, now a part of the Southern. In 1881 he was employed by the Baltimore & Ohio as an instrumentman and subsequently was promoted to assistant resident engineer and resident engineer on the Philadelphia division. He was appointed division engineer on the Mobile & Ohio in 1887 and in 1889 became locating engineer and resident engineer on the Seaboard Air Line. In 1891 he was appointed assistant engineer on the Baltimore & Ohio and in 1892 became locating engineer on the Chesapeake & Ohio. He was appointed chief engineer on the Ohio Southern in 1893, and in 1894 was appointed locating engineer of the Virginia, Fredericksburg & Western. From 1897 to 1899 he served as assistant engineer, in charge of harbor and seacoast defense work, in the War Department. He was appointed chief engineer of the Pittsburgh & West Virginia in 1899, and held this position until 1901, when he was appointed chief engineer of the West Side Belt Railroad. He was chief engineer of the Wheeling & Lake Erie from 1904 to 1912, when he became chief engineer of the Chicago & Alton.

H. T. Douglas, Jr.

F. H. Watts, assistant to the chief engineer maintenance of way of the Central region of the Pennsylvania, with headquarters at Pittsburgh, Pa., died in that city on April 13. Mr. Watts was born on March 29, 1876, at Natick, Mass., and graduated from the Massachusetts Institute of Technology in 1897. He entered railway service in June, 1899, in the engineering department of the Chicago & North Western. In June, 1900, he entered the service of the Pennsylvania and in January, 1904, was promoted to assistant division engineer. Mr. Watts was subsequently promoted to division engineer and in March, 1920, was promoted to engineer maintenance of way of the Illinois division. He held this position until February, 1924, when he was appointed assistant to the chief engineer maintenance of way of the Central region.

Howard M. Jones, supervising engineer in the Bureau of Valuation of the Interstate Commerce Commission, died suddenly in the offices of the Commission at Washington on March 29. Mr. Jones was born in 1875, at Murphysborough, Tenn. He attended Vanderbilt University at Nashville, Tenn., and received the degree in civil engineering at Union College, Schenectady, N. Y., in 1895. He entered the service of the Nashville, Chattanooga & St. Louis as an assistant engineer in 1895 and held that position until 1906. He later was placed in charge of estimates on new construction and supervision of accounts in the office of the chief engineer, in connection with maintenance of way. From 1906 to 1914 Mr. Jones engaged in private practice as a consulting engineer. In the latter year he was appointed a member of the engineering board of the Interstate Commerce Commission, in charge of the Southern region, with headquarters at Chattanooga, Tenn. On January 1, 1922, when the engineering board was abolished, Mr. Jones was appointed supervisor of engineering, bureau of valuation, and he held this position until his death.

Construction News

The American Refrigerator Transit Company has called for bids for the construction of an ice manufacturing plant at Grand Junction, Colo., to cost approximately $250,000.

The Atchison, Topeka & Santa Fe has called for bids for the construction of a sand plant at Topeka, Kan.

The Baltimore & Ohio has awarded a contract to Joseph E. Nelson & Sons, Chicago, for the construction of pump houses and pipe lines at Baltimore, Md., to cost approximately $30,000 and has awarded a contract to the Chicago Bridge & Iron Works for a water softening tank, 40 ft. in diameter and 57 ft. high (547,000 gal. capacity) at Connellsville, Pa., the International Filter Company, Chicago, to furnish the water softening machinery. This company is contemplating the elimination of grade crossings on its subsidiary, the Staten Island Rapid Transit, preliminary to electrification.

The Boston & Albany has awarded a contract to the Tredennick-Hillings Company for the construction of a baggage mail and express building at Springfield, Mass., to cost approximately $600,000. A contract has also been awarded to the J. G. Roy & Sons Company for grading and construction of a fourth main track between Niverville, N. Y., and Post Road (2.5 miles) to cost approximately $375,000.

The British Columbia Electric has awarded a contract to Stewart & Barber, Vancouver, B. C., for the construction of a five-mile logging road in British Columbia, to cost $150,000.

The British Columbia Lumber Road will construct a 20 mile line into the Harrison Lake district, British Columbia, by Thurston & Flavelle, Victoria, B. C., to cost approximately $300,000.

The Canadian National plans the construction of the following extensions in British Columbia, subject to approval of the Dominion Parliament; extension from near Kamloops, B. C., to Armstrong and from Vernon to Kelowna with a branch line from Vernon to Lumby, a total distance of 105 miles, at an estimated cost of $2,236,000; extension from Deerholme to Cowichan Bay, a distance of 80 miles, to cost approximately $358,000; extension of line of the Canadian Northern Pacific on Vancouver Island from mile 74 to mile 100, at an estimated cost of $348,000. This company will improve its coal handling facilities and roundhouse at Stratford, Ont., at a cost of $140,000. Of that total $125,000 will be spent in the renovation of the roundhouse. Fourteen of the stalls will be lengthened 80 ft.

The Canadian Pacific is reported as about to construct an enginehouse at Schreiber, Ont., at a cost of $150,000, to replace a building recently destroyed by fire.

The Canadian Robert Dollar Company plans the construction of a standard gage logging road from Sayward, Vancouver Island, to a point near Campbell River, a distance of 25 miles.

The Central of Georgia will build a new station at Opelika, Ala., at an approximate cost of $75,000, and has awarded a contract to the Davis Construction Company, Atlanta, Ga., for the construction of a viaduct to carry Thirteenth street, Columbus, Ga., over its tracks, the work to cost approximately $300,000.

The Central of New Jersey has awarded a contract for the concrete sub-structure of Bridge 3 across the Lehigh river near Allentown, Pa., to the Empire Engineering Company, Baltimore, Md. This company has also let contracts to Richards & Gaston, Somerville, for 60,000 cu. yd. of grading and for a four-track, 50 ft. span, concrete arch in connection with the grade revision and yard at Somerville, N. J.

The Chicago & North Western contemplates the construction of a repair shop at Norfolk, Neb.

The Chicago, Burlington & Quincy has closed bids for the construction of water treating plants at Keokuk, Ia., Akron,

Colo., Ardmore, S. Dak., Clifton, Wyo., La Grange, Mo., Hannibal, Elsberry, Old Monroe and Machens.

This company plans the construction of a number of team tracks near the Union Depot in Denver, Colo. This will necessitate the removal of the Colorado & Southern coach yards to East Denver.

The Chicago, Milwaukee & St. Paul is considering the construction of a power plant at Miles City, Mont., but does not expect to do the work this year.

The Chicago, Rock Island & Pacific has completed plans for the construction, jointly with the El Paso & Southwestern, of a passenger station at Tucumcari, N. Mex. This company also plans the construction of a passenger station at De Baliviere avenue, St. Louis, Mo.

The Cleveland, Cincinnati, Chicago & St. Louis plans the construction of an addition to its shop at Beech Grove, Ind., at an estimated cost of $32,000. Bids will be called for in the near future.

The Detroit, Toledo & Ironton plans the construction of an engine terminal at Flat Rock, Mich.

The Duluth, Missabe & Northern has awarded a contract to the Mead Morrison Manufacturing Company, Chicago, for the erection of a coal handling bridge on the property of the St. Louis Bay Coal Dock Company in Duluth, Minn. The contract for the fabrication of steel has been awarded to the American Bridge Company and the contract for the electrical equipment has been awarded to the General Electric Company.

The Elgin, Joliet & Eastern closed bids on April 21 for the construction of a power house at Joliet, Ill.

The Erie is completing the plans, specifications and invitations for bids on its grade crossing elimination project for Paterson, N. J., work on which, by order of the New Jersey Public Utility Commission, must begin before May 15.

The Florida East Coast is completing the grading on the first unit of 20 miles of its Miami-Okeechobee extension (about 120 miles). Work on the second unit will then be taken up and the balance of the line will be completed progressively as drainage and development permit.

The Georgia & Florida contemplates an extension of line from Augusta, Ga., to Greenwood, S. C. (67 miles), the survey for which has been practically completed.

The Golden Belt has applied to the Interstate Commerce Commission for authority to construct a railroad from Great Bend to a connection with the Union Pacific at Hays, Kan., with a branch, making the total mileage about 80, to be operated co-operatively by the cities and townships along the route. Harry Freese, Hays, Kan., is secretary and attorney.

The Great Northern will construct with company forces one 70-ft. and two 40-ft. deck girder spans, with concrete piers, at Mason, N. Dak. This company is considering the construction of an enginehouse at Hillyard, Wash., but will not begin construction this year.

The Illinois Central has closed bids for the construction of subways in the track elevation work between 147th street and 171st street, Harvey, Ill. This company plans the construction of a second track on the St. Louis division at an estimated cost of $400,000.

The International-Great Northern plans the relocation of the switch yard at Taylor, Tex., at an estimated cost of $25,000.

The Jackson & Eastern has started work on a 15-mile extension to its line.

The Kansas City Southern has awarded a contract to the Pratt-Thompson Construction Company, Kansas City, Mo., for the construction of a six-story office building at Kansas City.

The Missouri Pacific has been ordered by the Arkansas Commission to construct a brick passenger station at Alma, Ark., plans to be submitted by April 15 and the construction to begin by June 1. This company is expected to rebuild its storage building and boiler shop and one or two smaller structures at Fort Scott, Kan., which were destroyed by fire on April 16, the loss being estimated at $30,000. This company has awarded a contract to the Railroad Water & Coal Handling Company, Chicago, for the laying of 2,800 ft. of 10-in. cast iron pipe at Texarkana, Ark.

The Long Island has approved the largest improvement budget in its history, which provides for the finishing of improvements carried over from 1923, together with several new undertakings, as follows: Electrification between Jamaica, N. Y., and Babylon, 27.6 miles, invloving about $4,000,000; the building of the central extension between Babylon and Farmingdale, a distance of 7 miles; electrification of the freight line between Bay Ridge, Brooklyn, and Fresh Pond, for interchange between the Pennsylvania and the New York, New Haven & Hartford; two new passenger stations and changes and improvements of several existing passenger stations; freight improvements in Long Island City, including additional floats, bridges and yard extensions to cost about $1,000,000; 17 projects involving grade crossing elimination to cost $2,100,000 and improvements to shop facilities amounting to $400,000.

The Louisville & Nashville has awarded a contract to the G. H. Rommel Company, Cincinnati, Ohio, for the construction of a freight station at Covington, Ky., reported in the November issue. This company will construct a steel bridge 826 ft. long, across Chef Menteur, New Orleans, La., at an estimated cost of $1,500,000.

The Maine Central has closed bids for the construction of a 4-stall engine house at Bingham, Me., to cost approximately $26,000. The company has awarded contracts to the American Bridge Company for the construction of two bridges—one at Waterville, Me., 4-span, to cost approximately $185,000, and another, 2-span, at Lewiston, to cost approximately $85,000.

The New York Central has awarded a contract to the McMyler Interstate Company for the installation of a car dumper at Ashtabula Harbor, Ohio, for the dumping of coal into lake vessels. The dumper will be of 120-ton capacity, 40 cars per hour; it will be operated by steam and electricity. The approximate cost of the car dumper with boiler plant will be upwards of $400,000, exclusive of foundations; with foundations, trackage facilities, etc., $1,000,000. This company plans the construction of a concrete subway under its two tracks and the two tracks of the Pennsylvania at Center street, Ashtabula, Ohio.

The Norfolk & Western has awarded a contract to H. A. Lucas, Bluefield, W. Va., for the construction of two concrete engine pits and a motor inspection pit at Auville, W. Va., to cost approximately $50,000. The company has authorized the strengthening of a number of bridges on its Cincinnati district to cost approximately $400,000.

The Oregon-Washington Railroad & Navigation Company has awarded a contract to the H. L. Wilson Company, Walla Walla, Wash., for the construction of an extension 5½ miles long from Milton, Ore., to Umapine, reported in the February issue. The construction will cost approximately $125,000.

The Pacific Electric has awarded a contract to Twohy Brothers, Portland, Ore., for the construction of a tunnel from Hill street station to the corner of First street and Glendale avenue, Los Angeles, Cal., to cost approximately $3,500,000.

The Pennsylvania has awarded the contract for the construction of a 900-ft. steel trestle and a concrete retaining wall in Cleveland, Ohio, included in the track elevation work at Cleveland. This company plans the construction of a cut-off from Louisville, Ohio, to East Rochester, a distance of 15 miles, which is estimated to cost $4,000,000.

This company has awarded a contract to M. J. McMenamin, Philadelphia, for the construction of a five-track reinforced concrete bridge over Beck's Run on the Pittsburgh division, to cost approximately $300,000.

The Prescott & Northwestern will soon call for bids for the construction of a 26-mile extension from Prescott, Ark., into Nevada county, reported in the April issue.

The Reading has awarded contracts to the H. Danburger Contracting Company of Bethlehem for the substructure and to the McClintic-Marshall Company, Philadelphia, for the superstructure of the north span of a bridge carrying the tracks of the Wilmington & Northern Railroad, a part of the Reading System, over the Schuylkill river south of Cumru Junction. This company has also awarded a contract to the Bennett-Randall Company, Lebanon, Pa., for the construction of the substructure of a highway bridge at Allentown, Pa., and for the superstructure to the American Bridge Company. A contract for the substructure of a highbridge at Tuckerton, Pa., has been awarded to the Bennett-Randall Company and for the superstructure to the Shoemaker Bridge Company, Philadelphia. This company has awarded a contract to Charles C. Pace, Merion, Pa., for the erection of a freight house and office building, with platforms, shelters and driveways at Marcus Hook, Pa. The contractor will furnish all the material in connection with this contract.

The Richmond, Fredericksburg & Potomac has revised its plans for the reconstruction of its timber bridge over Neabsco creek by a structure having steel bents, concrete sills and a solid concrete slab floor. Steel work will total about 1,000 tons for the fabrication and erection, of which a contract has been given to the American Bridge Company. The concrete work will be done by company forces. The total cost of the work will be apporximately $180,000.

The Seaboard Air Line in conjunction with the Florida, Western and Northern, has applied to the Interstate Commerce Commission for permission to build lines which with existing S. A. L. lines will form a short cross-state line between Tampa, St. Petersburg, Belleair and other points on the West coast and Palm Beach on the East coast. An extension from the cross-state line will run to Coleman to a connection with the Seaboard Air line. The new lines will total about 235 miles and will be laid with 100 lb. rail; maximum gradients will be less than 0.3 per cent and curvature less than 2 deg.

The Southern has awarded a contract to L. W. Hancock, Louisville, Ky., for the construction of a new roundhouse and flue shop at Spencer, N. C., and has awarded a contract to the Foundation Company, New York, for the construction of a freight terminal and coaling facilities at Knoxville, Tenn., to cost approximately $3,000,000.

The company has authorized the construction of new passing and storage tracks and extensions to existing tracks at the following points: Air Line Junction Yard, Charlotte, N. C.; Spencer, N. C.; Calverton, Va.; Nokesville, Va.; Weyburn, Va.; Culpeper, Va.; Shipman, Va.; South Richmond, Va.; Durmid, Va.; Pomona, N. C.; Reidsville, N. C.; China Grove, N. C.; Glass, N. C.; Hahn, N. C.; Gastonia, N. C.; Cramerton, N. C.; Bessemer City, N. C.; Elmwood, N. C; Swannanoa, N. C.; Old Fort, N. C.; Morganton, N. C.; Connelly Springs, N. C.; Saluda, N. C.; Landrum, S. C.; Campobello, S. C.; Volga, N. C.; Sandy Bottom, N. C.; Addie, N. C.; Hanes, N. C.; Barber, N. C.; Crutchfield, N. C.; Mt. Ulla, N. C.; Davidson, N. C.; Taylorsville, N. C.; Chester, S. C.; Rock Hill, S. C.; Blackstock, S. C.; Lena, S. C.; Loyall, Tenn.; Germantown, Tenn.; Burnsville, Miss.; Hillsboro, Ala.; Rossville, Tenn.; Middletown, Tenn.; Irvington, Ala.; Madison, Ala.; Gurley, Ala.; Hollywood, Ala.; Fackler, Ala.; DeArmanville, Ala.; Tarsus, Ala.; Hooper, Ga.; Weems, Brompton, and Bynum,; Ala.; Doubling and Lithia Springs, Ga.; Cook's Springs, Ala.; Bains, Ala.; Roberts, Ala.; Morgan, Ga.; Riverside, Ala.; Waco, Ga.; Jacksboro Yard, Knoxville, Tenn.; Volga, N. C.; Telford, Tenn.; Concord, Tenn.; Bearden, Tenn.; Harriman, Tenn.; Clinton, Tenn.; Chestnut Ridge, Tenn.; Tazewell, Tenn.; Maxwell, Tenn.; Luttrell, Tenn.; Williams Springs, Tenn.; Coran, Tenn.; Summit, Tenn.; Princeton, Ind. Short sections of double track will be constructed at Harriman and Loyall. On the Memphis division, 50 miles of track laid with 75-lb. rail will be relaid with 85-lb. The company is installing automatic signals and telephone dispatching circuits between Birmingham, Ala., and Atlanta, Ga.

This company has started work on extensive additions to its Inman Yards, just west of Atlanta. Six tracks, each with a capacity of 100 cars, and two tracks with a capacity of 50 cars each will be provided. The new tracks will enable the yard to take care of 500 more cars than at present and will bring its total capacity up to 4,000 cars. The necessary grading and filling will require the excavation of 37,640 cu. yds. of earth. This company has awarded a contract to the Consolidated Engineering Company, Baltimore, Md., for the construction of the 17-mile cut-off between Bulls Gap, Tenn., and Leadville, noted in the April issue.

The Southern Pacific is calling for bids for the construction of an additional 15 miles of the Natron cutoff from Oakridge, Ore., to Summit.

The company plans the reconstruction of its bridge over the Neches river at Beaumont, Texas, and will elevate its tracks in the city of Beaumont, Texas at a cost estimated at $1,272,000.

This company, jointly with the Union Pacific, plans the construction of approximately 11 miles of track within the city limits of Los Angeles, Cal. The new track, which will permit the joint use of the Arcade station by the two roads, will connect the Union Pacific at a point on the Los Angeles river bank with the Southern Pacific freight yard along San Fernando road.

The St. Louis-San Francisco has prepared plans for the construction of a new freight and passenger station at Sikeston, Mo. The building will be of brick and stucco and will cost approximately $30,000.

The Staten Island Rapid Transit, a subsidiary of the Baltimore & Ohio, has had its plans approved by the Public Service Commission of New York, for the electrification of 16.09 miles in the Borough of Richmond, New York City. The Commission has also ordered the double-tracking of the company's single track line between Prince's Bay and Pleasant Plains (one mile) and has directed that the company must submit to it before February, 1925, plans for the electrification of its remaining line (6.67 miles) and of its freight yards.

The Trinity & Brazos Valley contemplates the construction of an extension from Waxahachie, Tex., to Dallas, and the **Fort Worth & Denver City** contemplates the construction of extensions from Fort Worth, Tex., to Dallas, according to a recent announcement by Hale Holden, president of the Chicago, Burlington & Quincy.

The Union Pacific is reported as planning the construction of a freight and passenger station at North Bend, Neb., at a cost of $15,000.

This company has awarded a contract to Peterson, Shirley & Gunther, Omaha, Neb., for the construction of a 17-mile extension from Fort Collins, Colo., reported in the April issue.

This company plans the development of water facilities on the Los Angeles & Salt Lake, at a total cost of $250,000, including water softeners at Moapa, Nev., and Desert, Cal.; wells and pumps at Lund, Utah, Rox, Nev., and Desert, Cal., and additions to present facilities at Ivanpah, Cal., Kelso, Sands, Afton, Yermo, and Dry Lake, Nev.

The Valley & Siletz has received a certificate from the Interstate Commerce Commision authorizing the construction of an extension of 1½ miles in Independence, Ore.

The Wabash has awarded a contract to the Dwight P. Robinson & Co., for the construction, at Decatur, Ill., of a coach repair shop, 182 ft. by 142 ft., a coach paint shop, 182 ft. by 202 ft., a store house, 80 ft. by 450 ft., all to be steel frame buildings with brick walls, and a reinforced concrete oil house, 58 ft. by 50 ft. This company will construct extensions to six existing stalls and an addition of four stalls to the enginehouse at Moulton, Iowa.

The Western Pacific has awarded a contract to the Utah Construction Company, San Francisco, Cal., for the rehabilitation of its line between Wells, Nev., and Winnemucca, a distance of 183 miles, as provided in the recent agreement with the Southern Pacific for joint operation of this portion of the line. The contract includes the construction of bridge foundations but not bridge superstructures or signals.

Supply Trade News

General

The Truscon Steel Company has extended the territory of its San Francisco office to include the Hawaiian Islands.

The Erie Steam Shovel Company is preparing plans for the construction of a one-story brick and steel factory at Cleveland, Ohio.

The Joyce-Watkins Company has removed its main office from 332 South Michigan avenue to 410 North Michigan avenue, Chicago, Ill.

The Sellers Manufacturing Company has moved its general sales department from 1204 McCormick building, Chicago, to 1927 Illinois Merchants Bank building, effective April 23.

The Texas Creosoting Company has completed and placed in operation its timber preserving plant at Orange, Tex. The products of this plant are creosoted piles, poles, ties, timbers, cross arms and sheet piling.

The Smith-Heylandt Company has been organized, with headquarters at 2633 Fourth street, S. E., Minneapolis, Minn., to engage in the importation, sale and distribution of Heylandt apparatus for the manufacture of oxygen and other gases for use in welding and cutting.

The Muzzy-Lyon Company and the Federal Bearing and Bushing Corporation, both of Detroit, Mich., manufacturers of bushings, bearings and castings, have been merged into the Federal-Mogul Corporation. The business will consist largely in the production of babbit metals, heretofore specialized in by the Muzzy-Lyon Company and in the manufacture of bronze, bearings, bushings and bars, heretofore a specialty of the Federal Bearing & Bushing Company.

Personal

Arthur P. Skaer, assistant chief engineer of the Corrugated Bar Company, has been appointed district manager of the **Kalman Steel Company**, with headquarters at Buffalo, N. Y.

Al Michaels, assistant treasurer of the **Hyman Michaels Company, Chicago**, has been placed in charge of the company's Pittsburgh office with headquarters in the First National Bank building.

T. W. Snow, president of the T. W. Snow Construction Company, Chicago, died suddenly as a result of a fall at his home at Batavia, Ill., on April 26. He was born on August 5, 1858, at Bloomingdale, Ind. His first connection with railway service was in 1876 in the engineering department of the Chicago & North Western. He remained in the west for the following five years to regain his health and in 1885 entered the employ of the Pennsylvania Steel Company. He established the Chicago office of this company in 1886, and continued in this work until 1888, when he took charge of the railway and water departments of the U. S. Wind Engine & Pump Company, Batavia, Ill. He remained in this position until 1898, when he was appointed manager of the western office in the railway department of the Otto Gas Engine Works, with headquarters at Chicago. He was elected president of this company in September, 1906, and continued as president until 1911, when he organized the T. W. Snow Construction Company, Chicago, of which he was president until the time of his death.

T. W. Snow

S. F. Taylor, of the **S. F. Bowser Company**, Fort Wayne, Ind., has been appointed eastern representative of its railway sales division. Mr. Taylor has been with the Bowser Company over a period of fifteen years.

William C. Rudd, formerly engineer water service on the Louisville & Nashville, has entered private practice as consulting engineer, water pumping plants, power plants and heating plants, with offices at 307 Hazen building, Cincinnati, Ohio.

W. W. Arpe, assistant manager of sales of the Carnegie Steel Company, the Illinois Steel Company and the Tennessee Coal, Iron & Railroad Company, with headquarters at St. Louis, Mo., has resigned to become a special agent of the **Laclede Steel Company**, with the same headquarters.

A. R. Fathman, secretary and treasurer of the Western Tie & Timber Company, St. Louis, Mo., has been promoted to vice-president of this company. **Thomas T. Poleman**, assistant secretary and treasurer, has been promoted to secretary and treasurer, succeeding Mr. Fathman. Mr. Fathman entered railway service as a clerk in the traffic department of the Missouri Pacific in 1897. He went with the Western Tie & Timber Company in charge of traffic in 1907 and was elected secretary and treasurer in 1920. Mr. Fathman is also a vice-president of the Kettle River Treating Company of St. Louis.

C. A. Paquette, chief engineer of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Cincinnati, Ohio, has been appointed president of the **M. E. White Company**, the **White Construction Company** and other affiliated companes, with headquarters at Chicago. Mr. Paquette was born on April 2, 1872, at Detroit, Mich., and graduated from Notre Dame University in 1891. He entered railway service in July, 1891, as a transitman on the Lake Shore & Michigan Southern, and in May, 1892, he became a transitman on the Peoria & Eastern. From April, 1893 to July, 1894, he served as assistant engineer and from the later date until October, 1899, was engaged as engineer maintenance of way. He was superintendent from October, 1899 to September, 1902, when he entered the service of the Cleveland, Cincinnati, Chicago & St. Louis as superintendent at Indianapolis, Ind. From June, 1906, to December, 1912, he served as assistant chief engineer at Cincinnati, Ohio, and from the latter date to March, 1915, was chief engineer maintenance of way. He became chief engineer in March, 1915, and was holding that position up to the time of his affiliation with the White Construction Company.

Trade Publications

Okonite Installations.—The Okonite Company, Passaic, N. J., has recently issued an attractively bound, large size, 36-page, illustrated booklet on installations made by this company. Each page is devoted to individual illustrations of installations such as cable crossings, signals and interlockings, electrification, power houses, terminals, etc., at different points about the country and on a wide variety of railroads.

Twin Span Turntables.—The Bethlehem Steel Company, Bethleham, Pa., has issued a 30 page catalog, TS, illustrating and describing the twin span turntable developed and patented by that company. In addition to a description illustrated by general and detailed drawings and a statement of the advantages in this form of construction, the catalog contains a large number of photographs, showing the various construction features, as well as a set of views showing the turntables of this type in use on various railroads.

Waterproofing.—A four-page leaflet has been issued by Gardner & Lewis, Inc., 30 Church street, New York, which is the eighth of a series of information service bulletins being issued by this company on the use of asphaltic waterproofing products. The bulletin in question discusses the properties of Kroderproof coatings, outlines the use of this product in railway service, particularly for the protection of steel and concrete from brine drip and other corrosive agencies and concludes with general directions for applying the coating.

STATEMENT of the ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of *Railway Engineering and Maintenance*, published monthly at Chicago, Ill., for April 1. 1924.

State of Illinois, } ss.
County of Cook }

Before me, a notary public in and for the State and county aforesaid, personally appeared Lucius B. Sherman, who, having been duly sworn according to law, deposes and says that he is the Vice-President of the *Railway Engineering and Maintenance*, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Simmons-Boardman Publishing Company, 30 Church St., New York, N. Y.

Editor, Elmer T. Howson, 608 S. Dearborn St., Chicago, Ill.

Managing Editor, Walter S. Lacher, 608 S. Dearborn St., Chicago, Ill.

Business Manager, F. C. Koch, 30 Church St., New York, N. Y.

2. That the owners are:

Owner, Simmons-Boardman Publishing Co., 30 Church St., New York, N. Y. Stockholders owning or holding 1 per cent or more of the total amount of stock: Edward A. Simmons, 30 Church St., New York, N. Y.; Henry Lee, 30 Church St., New York, N. Y.; L. B. Sherman, 608 S. Dearborn St., Chicago, Ill.; Roy V. Wright, 30 Church St., New York, N. Y.; Samuel O. Dunn, 608 S. Dearborn St., Chicago, Ill.; Elmer T. Howson, 608 S. Dearborn St., Chicago, Ill.; Frederick H. Thompson, 6007 Euclid Ave., Cleveland, Ohio; Herbert L. Aldrich, 50 Central Park West, New York, N. Y.; Thos. Prosser & Son, 15 Gold St., New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: There are none.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholders or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

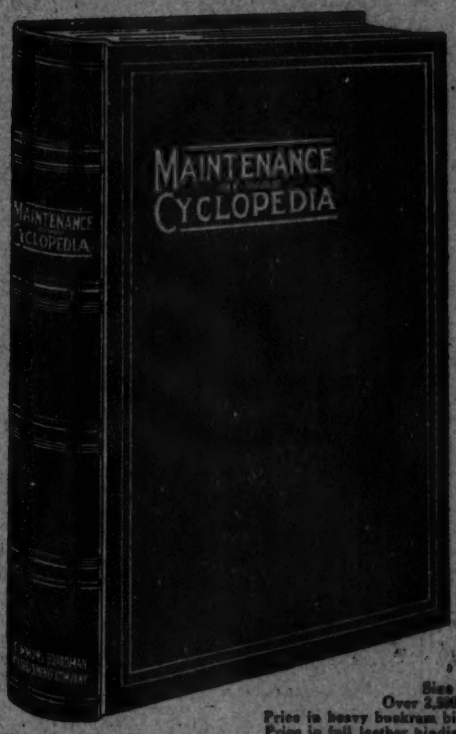
LUCIUS B. SHERMAN.

[SEAL]

Sworn to and subscribed before me this 31st day of March, 1924.

JULIA C. O'BRIEN.
(My commission expires June 12, 1924.)

"As useless as a locomotive in a plowed field."



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E. T. Howson, Western Editor of the *Railway Age*, and Editor of *Railway Engineering and Maintenance*.

E. R. Lewis, Formerly Chief Engineer of the Duluth, South Shore & Atlantic R. R.

K. E. Kellenberger (Signal Section), Editor of *Railway Signaling*.

—Assisted by—

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Principles and apparatus used in modern railway signaling are covered. Signal systems are illustrated in detail.

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Treats the subject fully including a key for the identification of woods as well as specifications for different preservative treatments.

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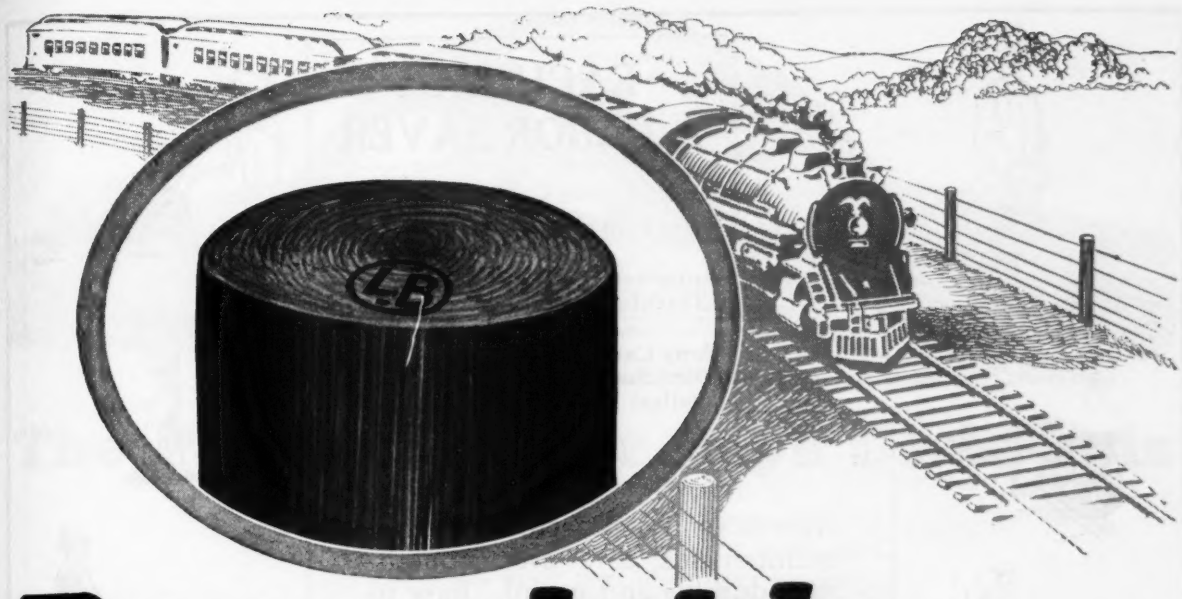
Describes in a specific manner various machines and appliances used in maintenance work, and where they may be obtained.



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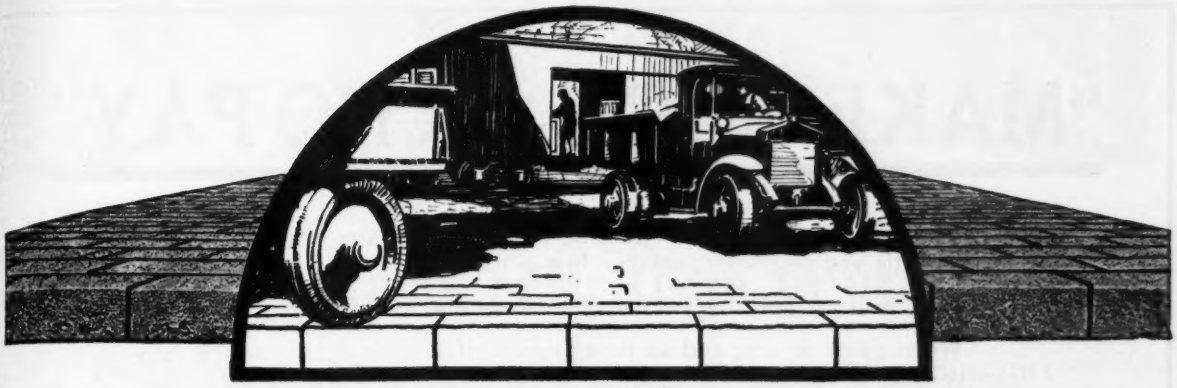

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Coffeyville, Kans.
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For True Paving Economy

Vitrified Paving

Brick

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Veedersburg, Ind.
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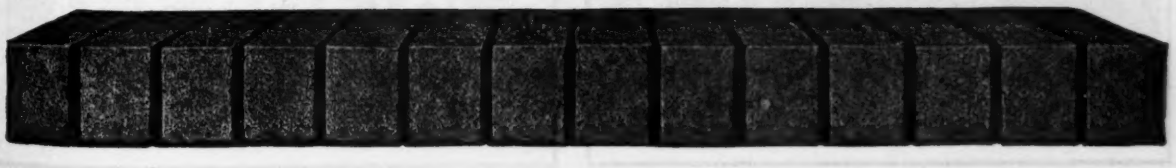

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THE IDOL TRACK LINER

Illustration No. 1

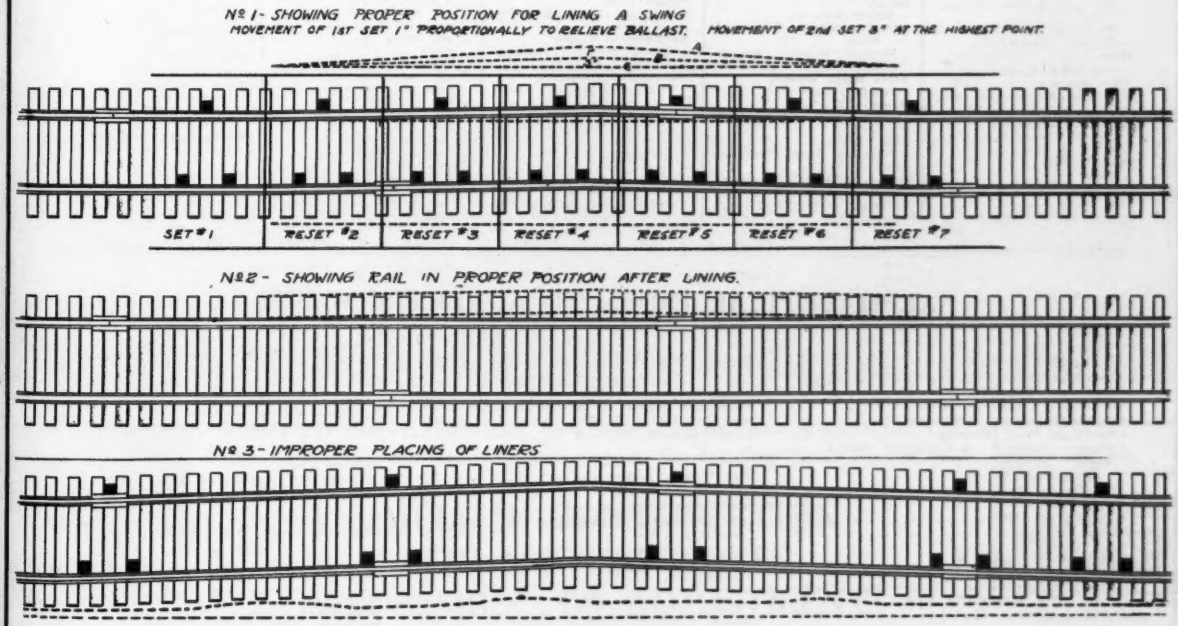
Illustration No. 2

Illustrations numbers 1 and 2 show the lining of ordinary track. Set two Liners against outside rail in direction to be lined, and one against inside rail.

Illustration No. 1 shows three men doing the same work with Idol Track Liners as was formerly done by seven to nine men with lining bars. The seven men using lining bars shown in illustration number 2 could not line the track; the three men with Liners moved the same track easily, without digging out the ballast at the end of the ties. When section crews are reduced to three men, all ordinary track can be lined without waiting for the organization of full forces, and without the doubling of section crews.

Now in Use on 61 Railroads

The most practical and economical labor saving device for lining track ever invented.
Saves at least 50% labor cost.



THE IDOL TRACK LINER CO.

717-723 South Wells St., Chicago, Ill.

Thos. D. Crowley & Co., Sales Agents **Peoples Gas Building, Chicago**

F. Hackmann, President and Mechanical Engineer **J. J. Franzen, Secretary and Treasurer**

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Idol Track Liner Co

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Water Treating Tanks.
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